MACHINERY

Design—Construction—Operation

Volume 43 JULY, 1937 Number 11

PRINCIPAL ARTICLES IN THIS NUMBER

FOR COMPLETE CLASSIFIED CONTENTS, SEE PAGE 764-P

Handling Two Million Pounds of Sheet Metal Scrap a Week *By Charles O. Herb* 701

Drilling and Reaming Tapered Holes in Steering Arms..... 705

Typical Operations in Making Ford Gages..*By Charles O. Herb* 706

How Die-Castings Effect Economies in Light Machine Tool Construction 710

Paying Investments in New Equipment..... 713

Editorial Comment 718

A Standard Depends Upon its Stability for its Value—Most Unemployment Due to Lack of Training for Industrial Work—Appearance, as Well as Utility, in Design of Machine Tools

Building Accuracy into Turret Lathes..... 722

Estimating Time Required for Machining..... 725

Drilling High-Manganese Steel with Cobalt High-Speed Steel Twist Drills.....*By Professor O. W. Boston* 733

Firth-Sterling Steel Co.'s New Carbide Sintering Plant..... 736

The Grinding of Detachable Rock Drill Bits..... 738

Modern Automatics Set New Pace in Production **is the leading article in August MACHINERY. It describes operations typical of present-day possibilities of automatic screw machines. Other unusual articles in that number will deal with how a large electrical plant makes and uses steel-rule cutting dies; "hot" milling; and the rapid drilling of smoke holes in pistons.**

DEPARTMENTS

Engineering News Flashes..... 716

Ingenious Mechanical Movements..... 719

Design of Tools and Fixtures..... 727

Ideas for the Shop and Drafting-Room..... 731

Questions and Answers..... 732

Materials of Industry..... 740

New Trade Literature..... 742

Shop Equipment News..... 745

PUBLISHED MONTHLY BY
THE INDUSTRIAL PRESS
148 Lafayette Street New York

ROBERT B. LUCHARS.....*President*
EDGAR A. BECKER..*Vice-pres. and Treasurer*
ERIK OBERG.....*Editor*
FRANKLIN D. JONES.....*Associate Editor*
CHARLES O. HERB.....*Associate Editor*
FREEMAN C. DUSTON....*Associate Editor*

LONDON: 52-54 High Holborn
PARIS: 15 Rue Bleue

YEARLY SUBSCRIPTION: United States and Canada, $3 (two years, $5); foreign countries, $6. Single copies, 35 cents. Changes in address must be received by the fifteenth of the month to be effective for the forthcoming issue.

Send old as well as new address.

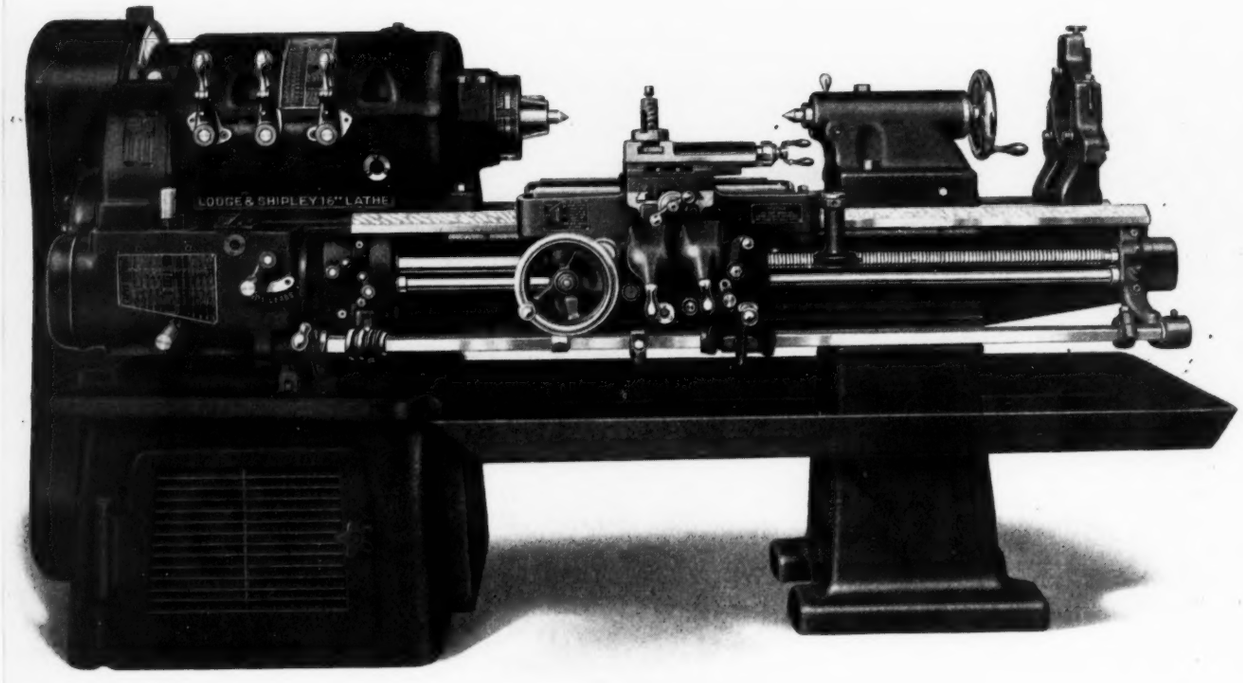
Copyright 1937 by The Industrial Press.
Entered as second-class mail matter, September, 1894, at the Post Office, New York, N. Y., under the Act of March 3, 1879. Printed in the United States of America. Member of A.B.P. Member of A.B.C.

Product Index 139-151

Advertisers Index 153-154

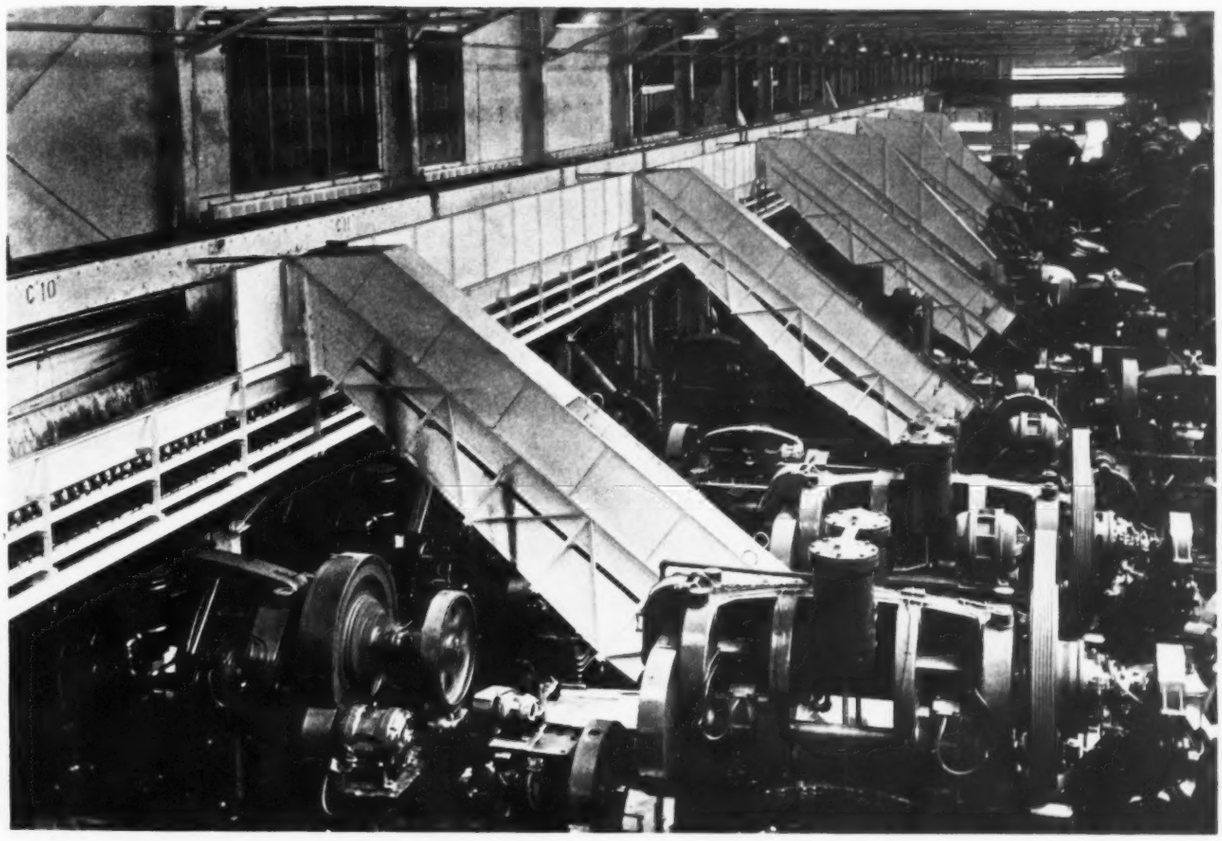
CIRCULATION 16,610

NO GADGETS!



MACHINERY

Volume 43 NEW YORK, JULY, 1937 Number 11



Handling Two Million Pounds of Sheet Metal Scrap a Week

Conveyors Carry the Scrap Direct from the Presses to Baling Machines and to Railway Cars without Any Delay. In this Way, the Aisles are Kept Clear, Labor is Saved, and Accidents are Prevented.

By CHARLES O. HERB

THE sheet metal shop of the Chevrolet Motor Co., Flint, Mich., turns out about 125,000 major chassis parts a day—25,000 fenders alone. In producing such a huge volume of work, obviously there must be a great deal of sheet metal scrap—it amounts to approximately 225 tons a day, or over two million pounds per five-day week.

The disposal of this huge amount of scrap previously was a formidable job. The scrap was carried by three overhead cranes to the balers and to the railroad cars. As the cranes could not pass each other, it was the practice for one crane to carry the scrap from the far end of the shop to a midway point and then dump it on the floor; the second

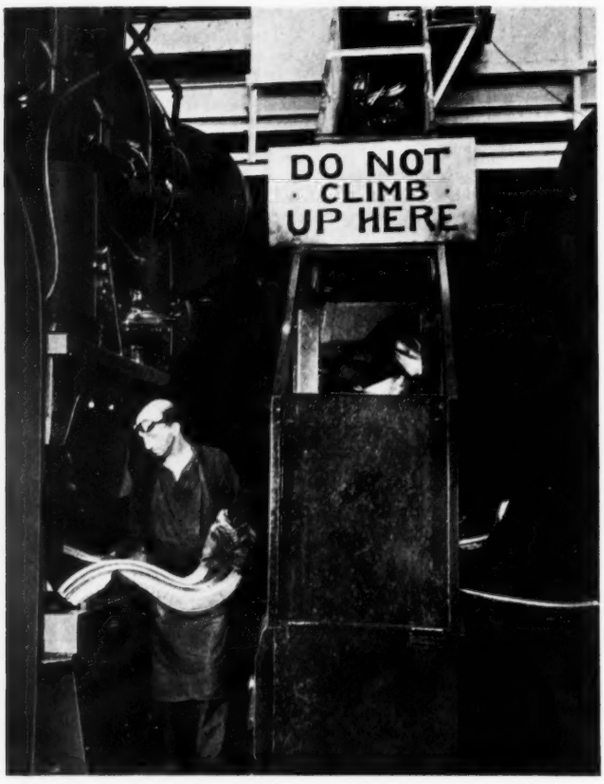


Fig. 1. Scrap Trimmed from Sheet-metal Parts on the Trimming Presses is Loaded into Short Inclined Conveyors which Carry it to an Overhead Conveyor Extending Practically the Entire Length of the Building

crane picked it up and carried it to the baler; and the third crane delivered the baled scrap to the railway cars.

With those scrap-handling provisions, the space around the machines was so congested that there was considerable interference with production. In addition, the scrap piled on the floor was an accident hazard, because of its sharp corners and jagged edges. Also, the balers always seemed to be in the way, regardless of where they were situated.

Conveyors Have Eliminated All the Former Inconveniences

All the disadvantages of the former method have been overcome by the installation of a conveyor system which extends from the trimming presses to the balers and then to the freight cars for shipment to the foundry. From the time that a piece of scrap falls from the dies of a trimming press until it reaches the freight car, it is in continuous motion.

Before describing the details of this conveyor system, it might be best to mention briefly the arrangement of the shop. All sheet metal stock is delivered to the inside of the building by flat railway cars which are shifted to a track extending along one side of the building. Cranes lift the metal sheets from these cars to a platform for inspection. They then progress transversely across the shop through blanking, drawing, and trimming presses, etc., and the finished parts are sent from the opposite side of the building by means of overhead conveyors to a loading platform that runs along an outside railway track.

Inclined Conveyors Carry the Scrap from the Trimming Presses to an Overhead Conveyor

Inclined conveyors extend from each gang of trimming presses, as seen in the heading illustration on page 701, to an overhead conveyor that runs practically the length of the shop, a distance of about 450 feet. There are seven of these inclined conveyors. The lower end of one of them is shown in Fig. 1. Scrap produced by the trimming presses is thrown on these conveyors through openings in the side of the sheet metal structure and delivered to the overhead conveyor.

This overhead conveyor consists of pusher bars which are carried along by two chains and move the scrap along a sheet-metal trough. Near the far end of the building, as seen in the heading illustration, the scrap is emptied into a chute which delivers it to the hopper of any one of three baling machines, as desired. This is accomplished by means of air-operated swinging doors in the chute, controlled by the operator seen in Fig. 2. With this arrangement, the scrap can be disposed of as quickly as it reaches the hopper loading chute.

When the Shop Runs at Full Capacity, 75 Bales are Made Hourly by Each Machine

When a sufficient amount of scrap has been discharged into a hopper, a man positioned as seen in Fig. 2 opens a valve to admit compressed air into a cylinder, which tilts the hopper upward. As the hopper reaches its upper position, the scrap is discharged into the baling machine, which is built into the floor. The hopper had been tilted several inches at the time that the photograph shown in Fig. 2 was taken. After the hopper has been emptied, it is returned to its former position to receive the next load. There is a man at each baling machine and a foreman for supervising the scrap handling system, but these are the only employes required for the immediate disposal of all the scrap.

After a baling machine has been loaded, the operator moves an air valve, which causes a heavy cover to slide lengthwise over the top of the baler pit and completely close it. Then a hydraulic ram of the same height as the baler pit advances from the left-hand end of the machine and compresses the scrap into a space 8 inches wide. Another ram of this width now rises from the bottom of the pit and compresses the scrap to a height of 10 inches.

Bales approximately 8 by 10 by 20 inches, weighing from 110 to 115 pounds, are obtained in this way, with the baler pit half filled at the beginning

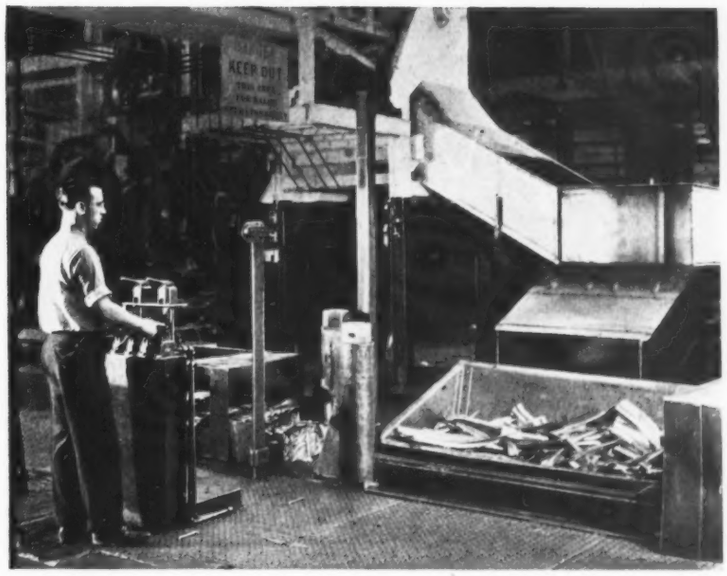


Fig. 2. The Sheet Metal Scrap is Delivered to a Chute from which it can be Directed by the Man Shown to Any One of Three Machines for Compressing into Convenient Bales

of the operation. Approximately 40,000 cubic inches of scrap are thus compressed into 1600 cubic inches. The hydraulic pressure applied to the bottom ram of the baling machine is about 1200 pounds per square inch, so that this ram exerts a total pressure of approximately 100 tons in squeezing the scrap into bales. The dimensions adopted for the bale were for the convenience of the foundry. When the rams of the baling machine are in the withdrawn position, the baler pit is 84 inches long by 8 inches deep by 20 inches wide.

The Bales are Carried Automatically to Gondola Cars

When the cover and horizontally moving ram of the baler recede at the end of an operation, the high-pressure bottom ram rises to the floor level, and an air-operated slide is advanced horizontally to push the finished bale into a chute leading to the lower end of an inclined conveyor. This conveyor carries the bales to a second overhead conveyor, seen in Fig. 3, which carries the bales to chutes from which they are discharged into gondola type freight cars. There are seven of these chutes. Three extend to the inside of the building, as shown in Fig. 4, and the other four to the outside.

Gates in the floor of the conveyor can be opened at the different chutes, so as to direct the bales through any one of them. In this way, the bales can be discharged to one end of a car, then to the center, and then to the other end by merely opening and closing gates. This is done electrically. To guard against a bale being caught in a gate and causing damage to the conveyor line, electrical devices prevent the conveyor from moving while a gate is being opened or closed.

With this arrangement for loading the freight

Fig. 3. The Baled Sheet Metal Scrap is Carried by a Second Overhead Conveyor to a Series of Chutes which Lead both to the Inside and Outside of the Building for Loading Railway Cars

Fig. 4. Five Gondola Cars are Loaded Daily with from 85,000 to 90,000 Pounds of Sheet Metal Scrap for Convenient Transportation to the Foundry—More than 2,000,000 Pounds in a Five-day Week!

cars, there is no need to have workmen in the cars spreading the bales uniformly, and the cars do not need to be shifted during loading. About five gondola cars are filled daily, each taking bales weighing a total of 85,000 to 90,000 pounds. Through this provision for loading cars within the building or outside, there is no delay in the baling activities when freight cars must be shifted.

Comparatively little power is required for operating the conveyors of this system. A five-horsepower motor drives each overhead conveyor, while the inclined conveyors are driven by individual motors of three horsepower. Transitorq variable-speed reducers make it possible for the conveyors to be driven at suitable speeds to meet production requirements.

What the Machine has Done for the Consumer of Machine-Made Products

A HIGH-GRADE radio now retailing for $100 would have to be sold for $1000 if it were made without the aid of the mass-production facilities now employed.

Stoves, refrigerators, and washing machines would cost anywhere from six to ten times what they do today if the plants manufacturing them were not tooled with modern equipment.

Precision looms of a type that was not available a few years ago reduce weaving costs from 15 to 30 per cent. Without this improvement in looms, the selling prices of fabrics for men's and women's clothing would be much higher than they now are.

By reducing the use of labor per 1000 pounds of produce shipped by 40 per cent from 1914 to 1935, Swift & Co. increased the number of people employed from 23,654 in 1914 to 31,527 in 1935. *Decreased* costs *increased* demand, and created more employment.

"Except for modern production methods," says Louis Ruthenberg, president of Servel, Inc., "automatic refrigeration would cost so much as to command an extremely limited market." This, in turn, would mean less employment. The use of modern machines, in this industry also, has increased employment.

Mass-production methods have been used almost from the very beginning in the telephone industry, and without such methods there actually would not have been any telephone service.

Mr. Chrysler estimates that a modern automobile selling for $600 would cost $3500 if made by the methods available some thirty years ago. If it were not for improved machinery, where would our automobile industry be that employs millions of people? The market for $3500 cars is limited.

Furniture in our homes and offices would cost approximately four times as much as it does today if present machinery and methods were discarded, estimates F. Stuart Foote, secretary-treasurer of the Imperial Furniture Co., whose computation is based on carefully kept records of the cost of producing small quantities for sample purposes.

The quotations above are from a collection of facts pertaining to production costs, available in a booklet entitled "More Goods for More People," published by the National Machine Tool Builders' Association.

Drilling and Reaming Tapered Holes in Steering Arms

THE two tapered holes in the forked end of the automobile steering arm illustrated in Fig. 1 are drilled and reamed at the plant of the Gemmer Mfg. Co., Detroit, Mich., on two Barnes Hydram machines set up as shown in Fig. 2. One of the tapered holes is produced complete by the first machine, and the other hole by the second machine, the two holes being in different planes. One of the holes is parallel to the larger straight hole in the opposite end of the steering arm, while the other tapered hole is at an angle with the straight hole. Both machines are equipped with hand-indexed five-station work-fixtures.

For the first operation, the steering arms are located on the fixture by slipping the previously reamed hole of the large end over a stud at the front of the fixture. There are two of these locating studs positioned side by side to provide for the accommodation of both right- and left-hand steering arms. The boss to be drilled and reamed in the first operation is located by a V-block.

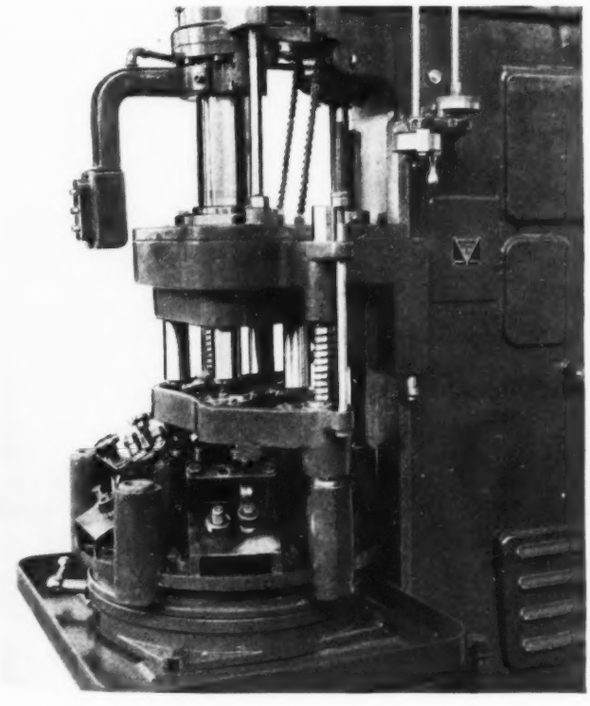


Fig. 2. Barnes Hydram Machine Arranged for Drilling and Reaming One of the Tapered Holes in the Automobile Steering Arm. The Second Tapered Hole is Produced in a Similar Machine

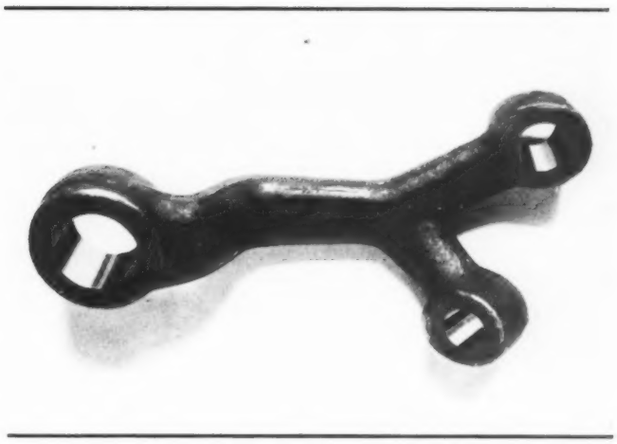


Fig. 1. Automobile Steering Arm with Two Tapered Holes which are Drilled and Reamed on Two Machines Set up as Illustrated in Fig. 2

In the first station to which the fixture is indexed after loading, a 19/32-inch straight hole is drilled through the boss. This hole is rough-reamed to a taper in the next station, semi finish-reamed in the third, and finish-reamed in the fourth. The finishing reamer is mounted in a floating holder, but the other reamers are guided by pilots and bushings.

In producing the second tapered hole in the other machine, the part is located on the fixture both from the large reamed straight hole and from the tapered hole that has just been drilled and reamed. The tapered holes measure 0.625 inch in diameter at the small end and taper 1 1/2 inches per foot, the bosses being 7/8 inch long. The work-fixture of both machines is locked in the indexed positions by means of a handle at the front of the machine.

* * *

Ten-Year Record of Apprentice Training

In 1926, the Tri-City Manufacturers' Association, comprising manufacturers in Davenport, Iowa, and Rock Island and Moline, Ill., and including also manufacturers in East Moline and Silvis, Ill., and Bettendorf, Iowa, launched a unique apprentice training program in cooperation with the public school authorities and the International Correspondence Schools of Scranton, Pa. This apprentice program has proved, during the ten years that it has been in operation, to give unusually satisfactory results. The best evidence of this is that the program was continued, uninterrupted by the depression. Stanley M. Brah has published a booklet giving details of this apprentice program and outlining its results, to which D. C. Vandercook, director of the Personnel Training Division of the International Correspondence Schools, has added considerable material obtained by the cooperation of the manufacturers' apprenticeship committee and men connected with the school systems. This booklet may be obtained from the International Correspondence Schools, Scranton, Pa.

Typical Operations in

Some of the More Interesting Grinding and Thread-Lapping Operations that are Everyday Practice in the Gage Plant of the Ford Motor Co.

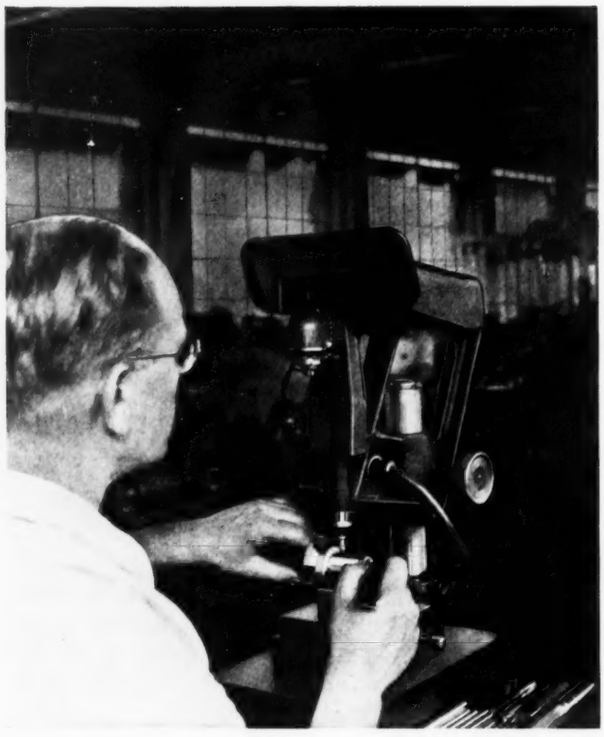
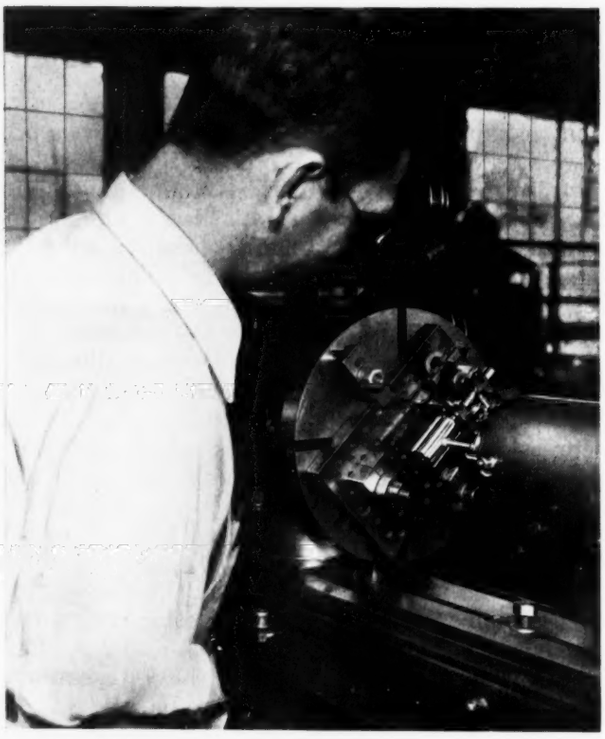


Fig. 1. Each Workman is Provided with Inspection Equipment that Enables Him to Attain the Close Accuracy Specified for Ford Gages

Fig. 2. Grinding a Small Hole Transversely in a Splined Pilot by the Use of a Rivett Grinder. The Tapped Surface Plate Facilitates Various Work Set-ups



ALL small gages used in the various plants of the Ford Motor Co. are made within a small two-story factory building at Waterford, Mich., under ideal working conditions, which were described in an article published in June MACHINERY. One of the rules of this plant is that each man is held responsible for the accuracy of his work, there being no inspectors. The machine operators and bench men are provided with Johansson indicator gages, Zeiss Optimeters, Sheffield electric visual gages, and other instruments to assist them in finishing the gages within the prescribed limits of accuracy. Thirteen sets of Johansson gage-blocks are in constant use for setting inspection devices. These gage-blocks are replaced periodically, so that no one set is used as long as a year.

All roughing operations are performed on the first floor of the building by turret lathes, shapers, drilling machines, and surface grinders. There is also a heat-treating department on the first floor in which there are hardening and tempering furnaces that are fired by kerosene to avoid smoke and soot. In addition, there is a small electric hardening furnace. All finishing operations are performed on the second floor of the building, which is largely equipped with grinding machines of various types. There are, however, thread-cutting lathes, milling machines, a jig boring machine, and other machine tools of the tool-room type.

Grinding is a Widely Employed Operation in a Gage Plant

Internal grinding is performed on precision machines built by Rivett Lathe & Grinder, Inc. Fig. 2 shows a typical operation on one of these machines. It consists of grinding a hole in a splined pilot for a fixture gage to a diameter of 0.5005 inch, within plus 0.0005 inch and minus 0.0000 inch. A hardened and ground bushing is later assembled in this hole.

Attached to the faceplate of this machine is a surface plate with a large number of tapped holes that facilitate various work set-ups. On this surface plate directly opposite the work, a block and cylindrical plug are mounted to serve as a counterbalance for the V-block in which the shank of the work is clamped.

Making Ford Gages

By
CHARLES O. HERB

A typical operation on a Brown & Sharpe cylindrical grinding machine is illustrated in Fig. 3. This operation consists in grinding a plug gage having a nominal diameter of 2 1/4 inches at both ends. The gage is ground cylindrical for several inches at both ends and to a slight taper in the middle. The over-all length is 13 inches.

Female spline gages of the type seen in Fig. 4, which are used for inspecting splined shafts, are held to extremely close tolerances as regards the relation of the splines to the lapped center hole and also as regards the location and width of the splines. The machine in which these gages are ground was equipped with a fixture designed for easy mounting and indexing of the work. Correct alignment of the splines is insured by grinding the surfaces of opposite splines simultaneously with each movement of the work-table toward the grinding wheel. The sidewise adjustment of the table is used to grind the splines to the desired width, and this dimension is checked by applying combinations of Johansson gage-blocks in the manner shown.

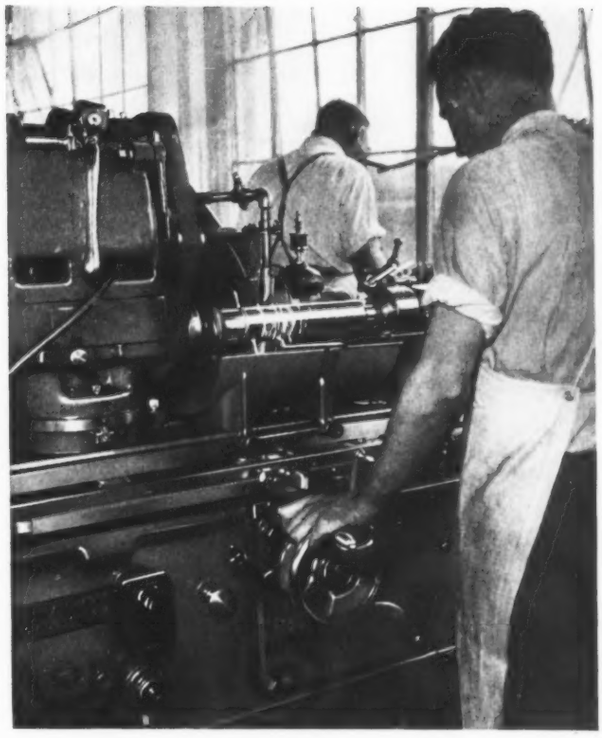


Fig. 3. Grinding a Plug Gage 2 1/4 Inches in Nominal Diameter by 13 Inches Long. The Section between the Cylindrical Ends is Tapered

Fig. 4. The Opposed Splines of Female Spline Gages are Ground with One Pass of the Wheel and Checked with Built-up Combinations of Johansson Gage-blocks

Thread Gages are Lapped on Reversing Heads

All thread gages are lapped after hardening, in order to correct any errors in lead, pitch, and thread contour. Cast-iron laps threaded to mate with the gages are used. Rough-lapping is done with the lap mounted on a simple motor-driven head, as shown in Fig. 5, which can be reversed electrically by merely turning a switch handle. With this equipment, the gage can be quickly fed backward and forward on a lap until the desired fit and finish have been obtained. Finish-lapping is performed entirely by hand. Long thread gages are ground prior to the lapping operations.

The Société Genevoise jig boring machine, shown in Fig. 6, is used extensively for producing holes in gage parts when the spacing of the holes is held within close tolerances. The illustration shows a member for a fixture gage which has nine holes that had to be bored in a flange concentric with the central hole and also equidistant from each other.

All gages used in the Ford plants, with the exception of thread gages, are salvaged, time after

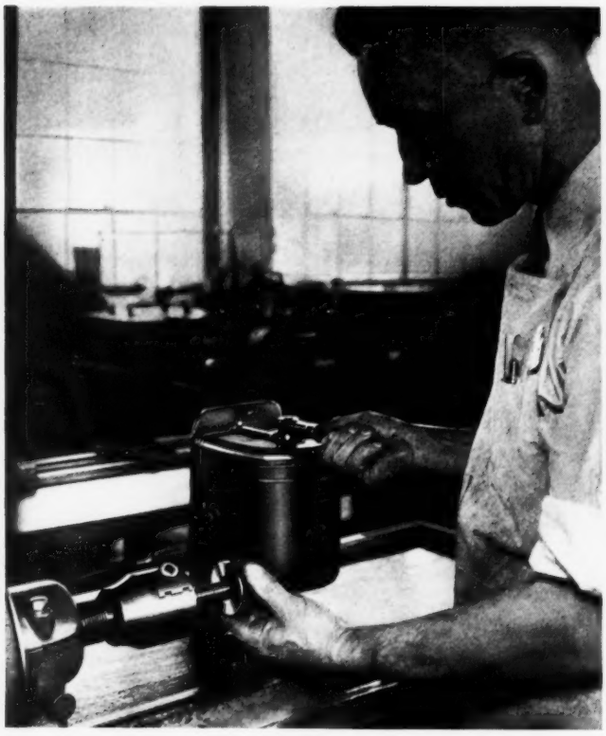


Fig. 5. Thread Gages are Rough-lapped on a Motor-driven Head that can be Reversed Instantly by Operating a Switch Handle

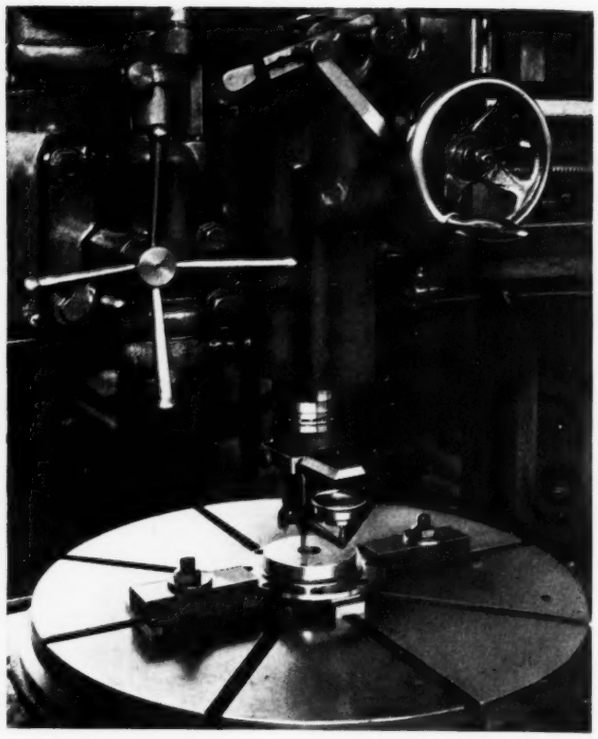


Fig. 6. This Jig Boring Machine is Constantly Used on Gage Parts Having Holes that Must be Accurately Spaced

time, by chromium plating as they become worn. Such gages are returned to the gage plant where they are ground under size or over size about 0.006 inch on the diameter to allow for chromium plating. The gages are then plated at the River Rouge plant, after which they are again returned to the gage plant for grinding the plating to the original dimensions of the gage. Generally about 0.015 inch of plating on the diameter is ground off.

When chromium-plated gages have been worn down in use, the remainder of the plating is stripped off, after which the gages are again plated and are sent to the gage plant to be finished to the desired dimensions once more. With this practice, the life of gages is prolonged indefinitely.

The chromium plating of thread gages has not proved successful, however, due to the large number of sharp corners in the threads.

* * *

It is generally accepted that the penetration of water through brick walls is due largely to capillary cracks and openings which occur entirely by shrinkage that develops in the body of the mortar during the first few hours or days of drying. The Truscon Laboratories, Detroit, Mich., have developed a material known as "Mortite" by the use of which a non-shrinking mortar is obtained which is also waterproof, thereby eliminating the disadvantages formerly encountered.

Productivity as a Remedy for Inflation

A booklet entitled "Productivity as a Remedy for Inflation" has been published by Allen W. Rucker, in collaboration with N. W. Pickering, president of the Farrel-Birmingham Co., Inc., Ansonia, Conn. This booklet makes a comprehensive study of the effect of efficiency on employment. A comparison is made between the efficiency of thirty major industries and their ability to increase and maintain employment. The facts are based on data reported by the U. S. Census of Manufactures. This study shows conclusively that there is no basis for the contention that increased productive efficiency limits factory employment. On the contrary, the worst records of employment for labor are found in the least efficient industries.

* * *

Proposed Mechanical Equipment Show

According to an announcement by the Textile Hall Corporation, Greenville, S. C., a Mechanical Equipment Show is proposed to be held in Greenville, April 11 to 16, 1938, provided a sufficient number of reservations to justify the show are received before October 15. It is believed that the time is ripe for an industrial show in the southeastern states. Those interested may obtain a prospectus from the Textile Hall Corporation, Room 205 Masonic Temple, Greenville, S. C.

CIRCULAR AND DOVETAIL FORMING TOOL BLANKS—3

(See Data Sheet No. 347 for Machine Group Classification)

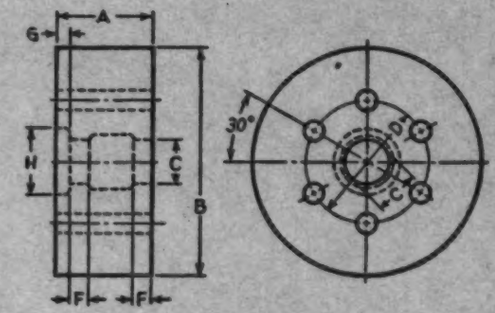


Table 3 Dimensions of Circular Tools With Counterbored Holes for Groups 4, 5, and 6

Group Number	Designation[1,2] of Blanks B × A	Width of Blank A	Diam of Blank B	Diam of Hole C	Adjusting Holes[4] Diam Pin Circle D	Adjusting Holes[4] Diam	Bearing Surface F	Counterbore Depth G	Counterbore Diam[3] E
4	3½ × ½ 3½ × ⅝ 3½ × ¾ 3½ × 1 3½ × 1½ 3½ × 2 3½ × 2½	½ ⅝ ¾ 1 1½ 2 2½	3½	¾	1⅞	¼	... ... 9/16 5/16 5/16	3/16 3/16 7/16 7/16 ⅜ ⅜ 1¼	1 1/32
5	4 × ⅝ 4 × 1 4 × 1½ 4 × 2 4 × 2½ 4 × 3	⅝ 1 1½ 2 2½ 3	4	1	2⅛	5/16	... ... 7/16 7/16 7/16	½ ½ ⅝ ⅝ ¾ ¾ 1¼	1 11/32
6	5 × ⅝ 5 × 1 5 × 1½ 5 × 2 5 × 3 5 × 4	⅝ 1 1½ 2 3 4	5	1	2⅛	5/16	... ... 7/16 7/16 7/16	½ ½ ⅝ ⅝ ¾ ¾ 1¼ 2¼	1 11/32

All dimensions are given in inches.

Tolerance for dimensions not otherwise specified shall be held to ±0.010.
[1] Circular tool blanks are designated by outside diameter and width of tool blank.
[2] Blanks made of high speed steel shall be stamped with H.S.
[3] A slight radius shall be provided at the bottom of the counterbored hole H.
[4] The tolerance on the diameter of the six adjusting holes is plus 0.002 and minus 0.000. The tolerance on the diameter of the pin circle "D" is plus and minus 0.002.

MACHINERY'S Data Sheet No. 349, New Series, July, 1937
Approved by American Standards Association, November, 1936

CIRCULAR AND DOVETAIL FORMING TOOL BLANKS—4

(See Data Sheet No. 347 for Machine Group Classification)

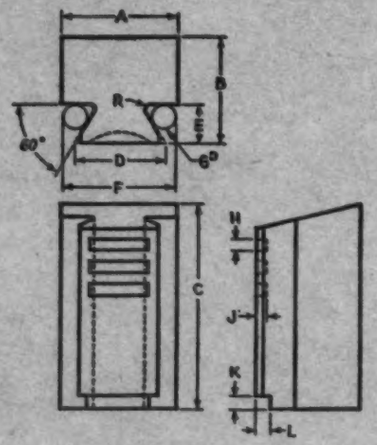


Table 4 Dimensions of Dovetail Tools

Group Number	Designation[1,2] of Blanks No. × A	Width A	Thickness B	Length C	Dovetail Width[3] D	Dovetail Thickness E	Dovetail Rad. R	Across Plugs F	Plug Diam G	Adj. Slots Width H	Adj. Slots Depth J	Optional[4] Adj. Slot Width K	Optional[4] Adj. Slot Depth L
1	1 × 1 1 × 1⅛	1 1⅛	1	1⅛	⅝	¼	1/32	0.849	3/16	⅛	⅛	⅛	⅛
2	2 × 1⅛ 2 × 1¼ 2 × 1⅜	1⅛ 1¼ 1⅜	1⅜	1½	⅞	⅜	1/32	1.125	⅛	⅛	⅛	3/16	5/16
3	3 × 1⅜ 3 × 2 3 × 2⅛ 3 × 2⅜	1⅜ 2 2⅛ 2⅜	1⅜	2	1¼	½	1/32	1.526	5/16	5/32	⅛	¼	¼
4	4 × 2⅜ 4 × 3 4 × 3½ 4 × 4	2⅜ 3 3½ 4	2½	2½	1¾	⅝	1/16	2.053	⅜	3/16	5/32	¼	¼
5	5 × 2⅜ 5 × 3 5 × 3½ 5 × 4	2⅜ 3 3½ 4	3	3	1¾	⅝	1/16	2.053	⅜	3/16	5/32	5/16	5/16
6	6 × 3 6 × 3½ 6 × 4 6 × 4½	3 3½ 4 4½	3½	4	2	¾	1/16	2.900	⅛	⅛	3/16	5/16	5/16

All dimensions are given in inches.

Tolerance for dimensions not otherwise specified shall be held to ±0.010.
[1] Dovetail tools are designated by group number and width of tool blank.
[2] Blanks made of high speed steel shall be stamped H.S.
[3] Width of Dovetail (D) measured to sharp corners.
[4] This slot is for a hook bolt, an optional method of adjusting dovetail tools.

Approved by American Standards Association, November, 1936
MACHINERY'S Data Sheet No. 350, New Series, July, 1937
MACHINERY, July, 1937—708-A

Transferring Blind Hole Lay-Outs

By F. MUIR

Transferring the location of blind holes from one machine part to another by the usual aligning methods requires a fair amount of skill. The writer has found, however, that most blind holes can be transferred directly by very simple means. Transferring the location of blind holes in a cylinder to a new cover is an example for which the simple methods are adapted.

If the work is light enough to be readily handled, the following method can be used. First, the face of the cover is smeared with black grease taken from the side of a machine bearing. This must not be the thin oil that works through a bearing, but rather the thick deposit nearest the metal. After applying a very thin coating of this grease over the cover face, a little gasoline is poured into each of the blind holes and the cover put on and clamped tightly in place. The parts are then turned upside down. After shaking the work for a few moments, the cover is removed. The location of each blind hole will be shown by a clean bright spot where the gasoline has washed away the grease.

Another method is to pour a little paint in each blind hole, assemble the parts, hold them upside down for a moment, then turn them right side up and leave them in this position for a few hours before removing the cover. When the cover is removed, the location of the holes will be shown by circles of paint.

When the work is too heavy to be turned upside down or when it is part of a fixed machine, the blind holes may be nearly filled with powdered chalk. A little liquid glue is then smeared on the work or cover in the approximate positions of the holes. The cover is next clamped down, after which it is tapped lightly all over with a hammer. When removed, the cover will have circles of chalk wherever a blind hole is located.

Another method that produces a clear-cut circle, which is suitable for reasonably accurate work and requires no special preparation, but takes more time, can also be used. It consists of dampening the face of the cover with a wet cloth, laying the cover on the part with the blind holes without clamping it down, and leaving it over night. When the cover is removed the next morning, a slightly discolored circle will show the location of each blind hole. For extreme accuracy, however, the more elaborate set-up methods must be used, but they should be avoided when any of the simpler, more direct methods described will serve equally well.

* * *

New Officers of the Gear Manufacturers' Association

At the recent annual meeting of the American Gear Manufacturers' Association, held at Galen Hall Hotel, Wernersville, Pa., the following members were elected to serve on the executive committee: R. C. Ball, Philadelphia Gear Works; Howard Dingle, Cleveland Worm & Gear Co.; F. B. Drake, Johnson Gear & Mfg. Co.; and U. S. Eberhardt, Newark Gear Cutting Machine Co.

H. H. Kerr, president of the Boston Gear Works, was elected president of the Association; Howard Dingle, president of the Cleveland Worm & Gear Co., was elected vice-president; and J. H. Jackson, of the Pittsburgh Gear & Machine Co., was re-elected treasurer. J. C. McQuiston, of Wilkinsburg, Pa., continues as manager-secretary.

H. H. Kerr, Recently Elected President of the A.G.M.A.

E. S. Sawtelle, Retiring President of the Association

Howard Dingle, New Vice-president of the A.G.M.A.

How Die-Castings Effect Economies

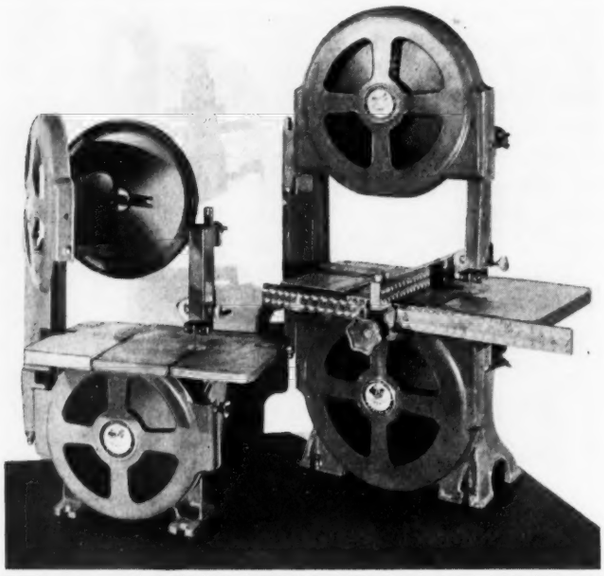


Fig. 1. Two "Driver" Band Saws, in which Zinc-alloy Die-castings have been Utilized to Obtain Machines of Good Quality at a Low Cost

EIGHT years ago the business of the Walker-Turner Co., Inc., Plainfield, N. J., consisted of manufacturing a few chain-store tools, such as hand drills and pulley-driven grinding and buffing wheels. No item retailed at more than a dollar.

Today this concern is known as the manufacturer of the "Driver" line of small machines, which includes drill presses, lathes, band saws, grinders, sanders, jig saws, routers, joiners, and so on, as well as flexible shaft units. The forerunners of this extensive line of equipment were conceived in 1931, when it was felt by the management that there was a market for low-priced machines of good quality in the field of the amateur craftsman who likes to spend leisure hours in a cellar, garage, or barn work-shop of his own.

The demand in this field grew rapidly, and home and farm work-shops still absorb the bulk of the machines produced by the company. However, beginning with 1935, another market for these light machines opened up as the executives of industrial plants became interested in them, not only from the cost angle, but also for reasons of adaptability, compactness, portability, and ease of replacement. The Walker-Turner Co. then developed their tools into somewhat higher grade units to meet the requirements of industry, still keeping them definitely in the low-cost class. Today machines of this type are being used extensively in the manufacture of electrical equipment, business machines, home appliances, shoe machinery, molded plastic products, etc.

Mass production methods, made possible because of the combined demands of home work-shops and the industrial market, are one of the reasons why these low-cost machines can be built of a high enough quality to suit manufacturing plants. Another reason is that shrewd designing has provided for the interchangeable use of many parts in different types of equipment. Typical parts of this character are handwheels, guides, guards, V-belt pulleys, quadrants, and gages. Simplification of design has been another economical factor.

With respect to materials, the main departure from conventional machine tool design is in the wide use of die-castings, practically all of which are made of zinc alloy. The use of die-castings was made possible primarily because production is large enough to warrant the required investment in dies; and die-casting has permitted substantial economies in reduced labor costs and decreased production time. Also, many machining and assembling operations have been eliminated, because die-cast parts are produced in smooth finished form direct from the molten metal. Some one-piece die-castings have replaced assemblies that consisted of two or more separate parts.

Numerous gray-iron castings, steel tubes, wrought-iron parts, and malleable-iron castings are also used in building these low-cost machines.

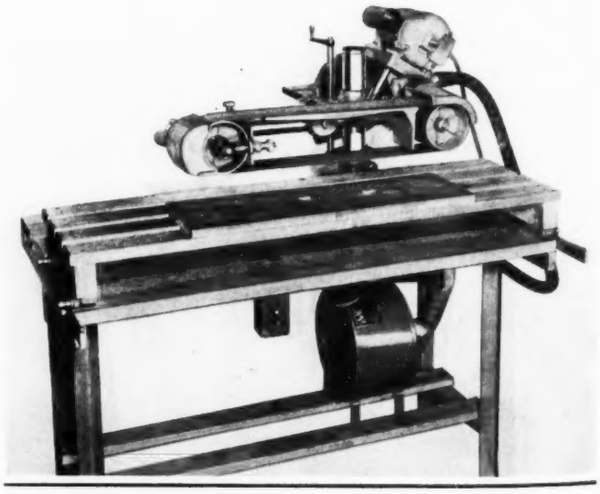


Fig. 2. Combination Band and Disk Sanding Machine, in which Zinc-alloy Die-castings are also Used to Effect Manufacturing and Maintenance Economies

in Light Machine Tool Construction

So, also, are machine-cut gears, porous and regular bronze bushings, ball bearings, and other more or less standard parts that were already available at low cost because of quantity production. All main frame castings, tables, etc., are gray-iron castings. Certain gears are made of laminated Bakelite for toughness and quietness of operation.

The keynote of this company's success in using die-castings has been in correctly judging the applications for which they are suited. Die-castings are used for parts where finish as cast, easy production, complexity in a single part, low cost, lack of resonance (noise), precision of detail, and mass production are requisites. Where heavy loads must be maintained over long periods, iron and steel members are used, so as to resist any tendency of the parts to take a gradual set. Non-ferrous alloys are also avoided for parts subjected to excessive wearing action. Simple stampings are used occasionally; but because zinc-alloy die-castings are now obtainable with thin sections, they have replaced many stampings. This has promoted silence in machine operation, saved die expense, and permitted bosses, lugs, ribs and beads to be integral.

For example, the split guards used around the pulleys of the band saws shown in Fig. 1, as well as the guards about the free saw sections just above the working table, could be stamped, but the die costs would be higher, their resonance would amplify noise, and ribs, bosses, and beads would be lacking or provided at an appreciable cost. Another advantage of zinc die-cast guards is that if a guard happens to come in contact with the saw during adjustment, the saw is not likely to be damaged. Advantage has been taken of this attribute of zinc by die-casting from zinc alloy an oval plate that is inset in the cast-iron table of every circular saw, so as to completely surround the blade.

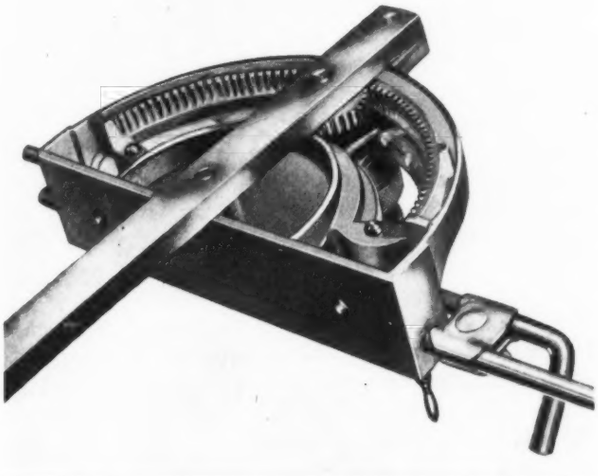


Fig. 4. A Miter Gage of which the Gear and Pinion Teeth, as Die-cast, Give Satisfactory Service. Degree Graduations are Also Die-cast in One of the Parts

Fig. 3. Battery of "Driver" Bench Drilling Machines Set up as a Production Line for Performing Successive Operations on the Same Part

Another interesting die-casting on band saws is a wheel-guard bracket having two long supporting arms of I-section. When this bracket was a malleable-iron casting, warpage occurred, and the extra expense of drilling and facing proved die-castings to be more economical.

Die-cast V-belt and step pulleys require only broaching of the bore and a slight turning cut for purposes of balance, whereas sand castings would necessitate considerably more machining. Because zinc alloys are softer than cast iron, pulleys made from zinc wear more rapidly, especially if the belts are kept tight, but the difference is not great and replacement is inexpensive.

Another instance where die-castings have simplified production is the self-indexing miter gage illustrated in Fig. 4. Gear-teeth integral with one of the castings do not need to be machined in order to mesh satisfactorily with the teeth of the pinion, which is also an unmachined die-casting. Another part of this unit has scale graduations cast in one of the surfaces. The manufacturing cost of this gage is surprisingly low.

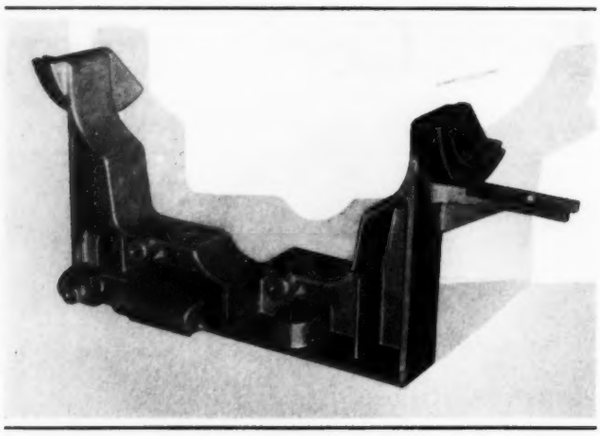


Fig. 5. Fourteen-pound Tilting Table Support for an Arbor Saw, which is Die-cast within Plus or Minus 0.003 Inch on 6-inch Center Lines

Large heavy die-castings support the tables of circular saws and permit of tilting them as required. These castings are produced with holes accurately cored and with semicircular tapered wall grooves that do not need to be machined in order to receive the tongues of sectors which rock in the grooves when the table is tilted. Unmachined tapered grooves may be seen in Fig. 5.

Tool for Chamfering Both Ends of Cylinder Bores

THE top and bottom ends of the cylinder bores in a six-cylinder automobile engine block are chamfered, as shown in Fig. 1, through the use of special tools that operate on both ends of the bores. These tools are of the construction illustrated in Fig. 2, and were produced by the Gairing Tool Co., Detroit, Mich. They are equipped with a single-point cutter *A* which chamfers the upper end of the bore, and a cutter *B* which is swung radially outward to chamfer the lower end of the bore after it has been fed downward through the bore.

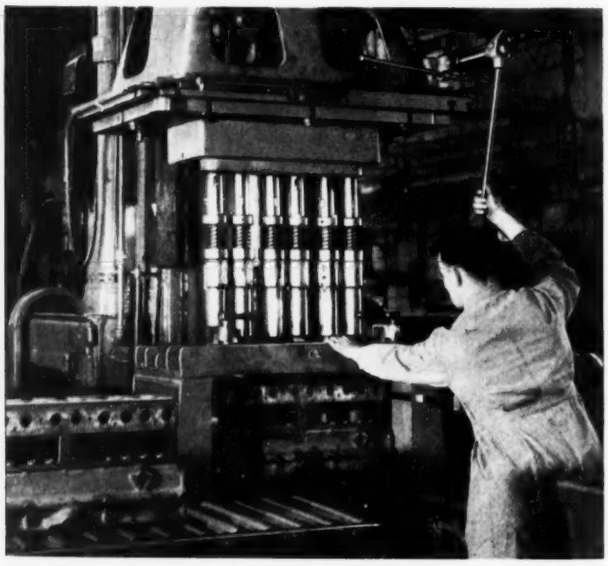


Fig. 1. Simultaneously Chamfering the Top and Bottom Ends of Six Cylinder Bores with Special Tools of the Construction Illustrated in Fig. 2

In operation, the entire tool is fed downward and revolved, with spring *C* expanded, until cutter *A* has completed its chamfering cut. Then, collar *D* having come in contact with the top of the pilot bushing, bar *E* is fed downward against the pressure exerted by spring *C*. This movement of bar *E* relative to sleeve *F* causes the upper end of tool-holder *H* to be swung downward around its pivot point, and the lower end of the holder to be swung radially outward for the chamfering cut at the lower end of the cylinder bore. A cam surface on the lower end of bar *E* holds cutter *B* firmly against the work while the cut is being taken, so as to avoid chatter of the cutter against the work.

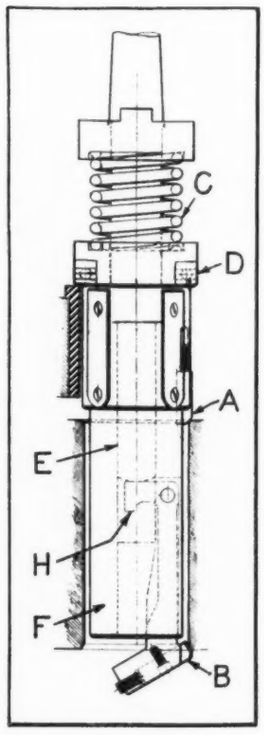


Fig. 2. Tool that Takes Two Chamfering Cuts at Opposite Ends of Cylinder Bores

Upon the completion of the operation, a small coil spring, which is not shown in the diagram, forces cutter *B* toward the center of the boring tool, away from the cylinder bore. It will be evident that with this construction, scoring of the bore by the chamfering tool is avoided when bar *E* is pulled upward out of the cylinder at the end of the chamfering operation.

Paying Investments in New Equipment

Third Article in a Series from MACHINERY'S Modern Equipment Contest, Featuring Profitable Equipment Replacements in Various Manufacturing Plants

THE average plant owner or manager is not likely to be interested in equipment replacement when the possible savings appear to be merely theoretical in character or of the bookkeeping variety. However, every progressive executive responsible for production is keenly interested in actual reductions in manufacturing costs—reductions that mean money saved through the use of modern equipment or money lost by continuing to use obsolete equipment.

MACHINERY'S equipment-buying formula, published in the March number, is intended to provide shop owners and executives with a simple practical means of checking possible profits in actual dollars resulting from obsolete equipment replacement. The article that follows contains some more examples from manufacturers who have found that recently developed equipment is not only a good investment, but may be directly responsible for surprising cost reductions.

Operating Efficiency of Modern Upright Drilling Machine is the Chief Factor in Reducing the Unit Drilling Cost 33 Per Cent

Modern drilling machines often make it possible to effect great savings in production costs. The example that follows is particularly interesting because the more convenient control of the new machine is the important factor in reducing costs. In operating the old machine, both hands were required for starting it, while, with the new design, only one hand is used, so that the operator can use the other for placing the piece in the jig. The old machine was purchased in 1928 at a cost of $819, and the rate of production is 166 pieces per hour. The cost per thousand pieces is $3.60. The new machine was purchased in 1935 at a cost of $1000. The rate of production is 250 pieces per hour, and the cost per thousand pieces $2.40—a reduction of 33 per cent.

At the present time, the total number of pieces required annually is not large enough to keep the machine in operation every working day; however, when production increases so as to require full-time operation, the return on the investment will be about 48 per cent. This percentage is estimated as follows: The saving (before deducting depreciation) of $1.20 per thousand equals $2.40 per day = $672 in a year of 280 working days. Since the new machine costs $1000, the annual depreciation at 15 per cent = $150. The average interest on the investment at the rate of 6 per cent, allowing for annual depreciation = $34. The net saving, then, equals $672 — (150 + 34) = $488, or 48 per cent on the investment.—R. C. BECHERER, Superintendent of Ewart Works, Link-Belt Co., Indianapolis, Ind.

Surface Grinding Results in Large Savings in Material and Time

In a shop where duplicate parts are not produced in large quantities, so that machines are required which must be somewhat universal in their functions, figuring savings is more difficult than in the case of high-production single-purpose machines.

The machine on which this report is based is a hydraulic surface grinder equipped with a 16-inch diameter by 6-inch face wheel, a table 7 feet long with an 18- by 84-inch magnetic chuck, hydraulic

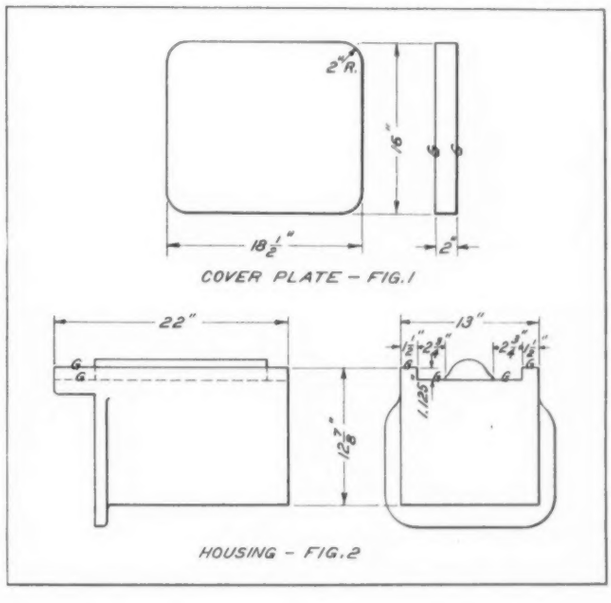


Fig. 1. By Surface Grinding These Cover Plates, the Total Yearly Savings in Material and Labor Equal 40 Per Cent of the Cost of the Machine

Fig. 2. By Grinding These Housings instead of Scraping Them, the Yearly Savings Equal 22 Per Cent of the Cost of the Machine

table feed and wheel cross-feed, and power traverse up and down for the wheel-head.

Although a variety of work, both in steel and cast iron, is ground on this machine, only two examples are cited to show the savings accomplished through the use of this equipment. The first part is the cast-iron cover plate shown in Fig. 1. The former method was to take two cuts on each side, a roughing and a finishing cut, with a high-speed steel inserted-blade face milling cutter on a vertical milling machine. In order to assure an oil-tight fit, it was sometimes necessary to do hand-scraping on some of the pieces. Savings due to the elimination of the scraping are not, however, included in this report.

With the new method, the allowance for finish on each side of the casting was reduced 9/32 inch, or to an average of 3/32 inch. One roughing cut is taken on each side with a tungsten-carbide tipped inserted-blade face milling cutter on the same milling machine, leaving 0.010 inch on a side for grinding. The piece was then put on the surface grinder and ground to size. The savings accomplished by the new method are based on the size part shown in Fig. 1, which is an average size for this type.

The yearly production is 510 plates and each plate has a total area of 585.2 square inches. A reduction of 9/32 inch of metal allowed for the finish saves annually 21,805 pounds. At $0.06 per pound, this saving in material amounts to $1308.

With the first method, the roughing and finishing cuts required 4 hours; with the new method, the roughing cut, with a tungsten-carbide cutter, requires 17 minutes per piece, and surface grinding 13 minutes, making a total of one-half hour per piece, or a saving of 3 1/2 hours per piece. Since the total production is 510 plates, the annual saving $= 3.5 \times 510 = 1785$ hours. The time saved on the job mentioned is used to advantage by grinding various other jobs on this machine. The total yearly savings of material and labor equal 40 per cent of the cost of the machine. This cost was approximately $10,800.

The second example is the housing shown in Fig. 2, on which the ways were formerly hand-scraped but are now ground. In scraping the ways, it required the time of two men, besides the use of a crane and other accessories such as rope slings, etc. Therefore, there is an additional saving accomplished in this change of methods which cannot be computed readily, such as releasing a crane for other operations. The yearly production on these housings is 266; the one shown in Fig. 2 is an average size.

The scraping time required per housing was 8 hours; the grinding time per housing is 2.5 hours; hence the saving per year on 266 housings at 5.5 hours each is 1463 hours. This yearly saving equals 22 per cent of the cost of the machine. The total yearly saving on these two parts equals 62 per cent of the cost of the machine.

The total grinding time for these two pieces amounts to 775.5 hours per year. If the machine were operated only for one shift of 40 hours a week for 50 weeks, or 2000 hours per year, there would still be available 1224.5 hours for other grinding operations producing similar savings. Figured on a most conservative basis, the machine will pay for itself in less than a year.

Saving 766 Hours per Year by Reaming Dowel-Pin Holes with an Air Drill

Certain types of machine tools, particularly special designs, require the use of dowel-pins in the assembled units after they have been located properly with respect to each other. A multiple-spindle drilling machine with units drilling from several directions is an example of this construction. The units must all be accurately located with respect to the holding fixture and then be doweled with taper pins. These holes formerly were reamed by hand. This was a slow, tedious job until an air drill was substituted for the hand work, which resulted in large savings.

The drill selected has a 3/4-inch square socket and 7/8 inch capacity; it is non-reversible and has a free speed of 350 revolutions per minute. The weight is 9 pounds 13 ounces. The cost, with all attachments and accessories, is $150. This drill has a right-angle attachment, making it possible to get close to the walls and into the corners. Standard spiral-fluted high-speed reamers are used. These were found to be better than the straight-fluted reamers because they reduced the tendency to chatter. The following table shows the savings accomplished through the use of this drill:

Taper Pin No.	Time Required, in Minutes		Saving, in Minutes	Pins per Year	Total Saving, in Hours
	By Hand	By Power			
6	20	5	15	136	34
8	30	10	20	1426	475.3
9	40	20	20	64	21.3
10	75	40	35	404	235.7
				Total savings per year, hours....	766.3

The savings were so apparent with the new method that a second drill was purchased shortly after the first one had been put in operation.—R. C. HEINMILLER, Engineer, The Foote-Burt Co., Cleveland, Ohio

Results from Modern Machine Tools in a Railway Repair Shop

The use of modern machine tools for speeding up production on locomotive repairs is an important factor in keeping locomotives out of the shop and in active service. The following examples are from the driving-box department of the Chesapeake & Ohio Railway Co.'s shop at Huntington, W. Va.

Machining of driving-box cellar fits is accomplished easily, quickly, and accurately on a draw-cut shaper with a special attachment for holding

the driving-boxes and double tool-holders for slotting the cellar fit. Cellar fits machined in this manner are square with the face of the box and true with the shoe and wedge faces and the center line of the axle. The floor-to-floor time is from 15 to 20 minutes. The cellar fits were formerly machined on a slotter, one side being machined at a time, thus requiring two set-ups, at an average time of one hour to the box.

The new method of machining effects a saving in direct labor of $1219 each year. When this work was done with a slotter, the annual labor cost was about $1828. The draw-cut shaper has reduced this annual cost to $609, thus saving $1219, not allowing for depreciation and interest. The cost of this installation was $4845. If we assume that the depreciation is 10 per cent and the interest rate 6 per cent, the annual depreciation plus average interest equals $644; hence, the net saving is $1219 — 644 = $575. The percentage of net profit over and above these carrying charges equals $\frac{575 \times 100}{4845}$ = 12 per cent, approximately.

Driving-box bearings, from the smallest to the largest, are fitted to the driving-boxes on an up-to-date draw-cut shaper designed especially for this job. This job formerly required two set-ups of the crown brass per fit; the outside diameter was turned on a mandrel, either in a lathe or boring mill, and the fit made by planing or shaping. The adoption of the draw-cut shaper for this particular job has cut the time practically in half, it being possible to fit brasses to boxes in from 20 to 30 minutes each, depending on their size, whereas the former method required from 40 to 60 minutes each.

The old method required eight hours a day and the labor cost was $1625 a year. The new machine is used approximately four hours a day and the labor cost is $812 a year, thus saving annually $813 before deducting depreciation and interest. The new installation cost $5252. If the rate of depreciation is assumed to be 10 per cent, the annual depreciation charge plus average interest equals about $700 a year. Therefore, on this job alone the new machine is more than paying its way and about one-half of the machine's time is still available for other work.

Up-to-date methods of fitting driving-box spreaders and cellars are accomplished by the use of another draw-cut shaper with special tool-holders for machining both sides of cellars or spreaders simultaneously. The cellars are so machined that the inside walls are true with the center line of the axle when applied to the driving-boxes, thus assuring a properly centered grease cake and perforated plate. The time on this operation has been reduced to one-third of that formerly required. The cellars formerly were fitted either on a slotter or a crank planer, machining one side at a time; most of the time was spent in setting up the work. The use of the draw-cut shaper for fitting these driving-box spreaders and cellars has reduced the time required to do this work from nine to three hours each day.

The yearly saving in labor before deducting depreciation and interest equals $1219. The installation cost $8956, and, on the basis of 10 per cent depreciation, the annual depreciation and average interest charge equals about $1190. This is another case where the saving exceeds by a small margin the total annual depreciation and interest charges and about two-thirds of the machine's time is available for other work.—E. A. MURRAY, Shop Superintendent, The Chesapeake & Ohio Railway Co., Huntington, W. Va.

* * *

Survey of Industrial Employment Shows Shortage of Skilled Labor

A serious shortage of skilled labor is revealed by a survey recently completed by the Warner & Swasey Co., Cleveland, Ohio. The survey is based on replies to a questionnaire on the employment situation received from 229 companies in a wide variety of industries employing, in total, over 790,000 people.

To the question "Are you experiencing a shortage of skilled labor?" 195 firms said "Yes," and 34 said "No." The types of men chiefly needed were machinists, toolmakers, machine operators, lathe operators, boring mill operators, automatic screw machine operators, and molders.

Questioned as to the best method of training men, 133 firms said that the best way was to employ them and teach them in one's own plant; 7 firms recommended joint training schools cooperatively run by several plants; and 18 said that they relied upon trade and vocational schools. A summary of the survey has been published by the Warner & Swasey Co. under the title "A Factual Survey of Industrial Employment."

* * *

Rising Taxes will Influence Cost of Living

Taxes paid by the steel industry in 1935 amounted to $134 per worker; the taxes for 1936 rose to $169 per worker. Obviously, increased prices of steel products must follow, since the companies must recover the money to pay the taxes. As the use of steel influences practically everything that is consumed, it is obvious that such increases in taxes will rapidly add their share to a higher cost of living. The ultimate consumer must always pay the tax. It does not really matter who is taxed; all taxes on production are ultimately passed on to the consumer; and justly so, because he is the one who through his vote approves or disapproves of increased taxation.

Engineering News Flashes

The World Over

Boiler Generating Steam at 1900 Pounds Pressure

Two boilers generating steam at the highest pressure ever used in England are being installed by the North Metropolitan Electricity Supply Co. of London. These boilers will generate 210,000 pounds of steam per hour each, at a pressure of approximately 1900 pounds. They will supply a 50,000-kilowatt turbine-generator set. The high-pressure generator will exhaust the steam at 195 pounds to reheaters, from which the steam will be returned to the low-pressure turbine.

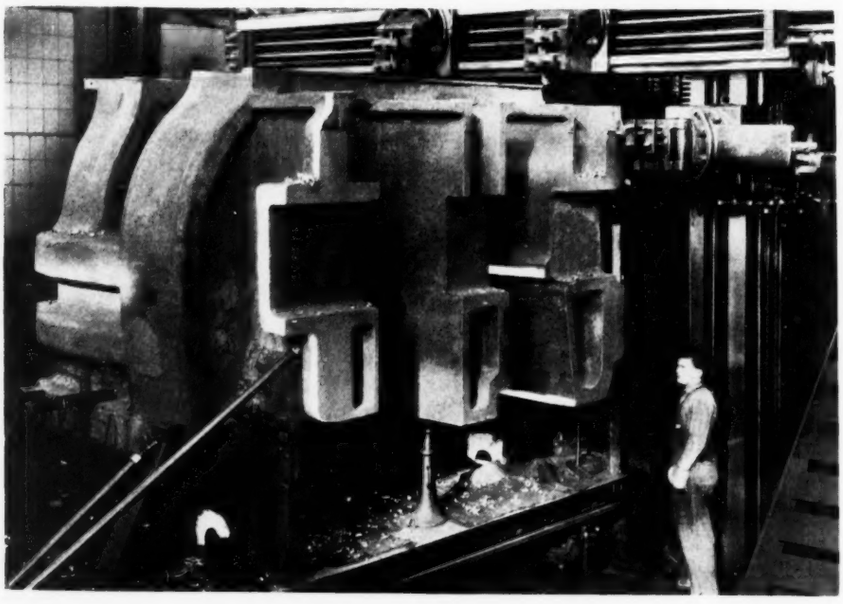
Invisible Electric Eye Operates Burglar Alarms

How an intricate net of invisible electric rays can be used to operate burglar alarms was recently demonstrated at a meeting on the fourth floor of the General Electric Building in New York City, where an area of 13,000 square feet in extent was protected by invisible electric rays. The protective network originated with a beam from a regular automobile headlight bulb, from which all visible rays of the light spectrum had been filtered. By a multiple system of mirrors, this single invisible beam was reflected back and forth across the area, around corners, and at different levels and angles, until the guarded area was completely protected against anybody entering it from any direction.

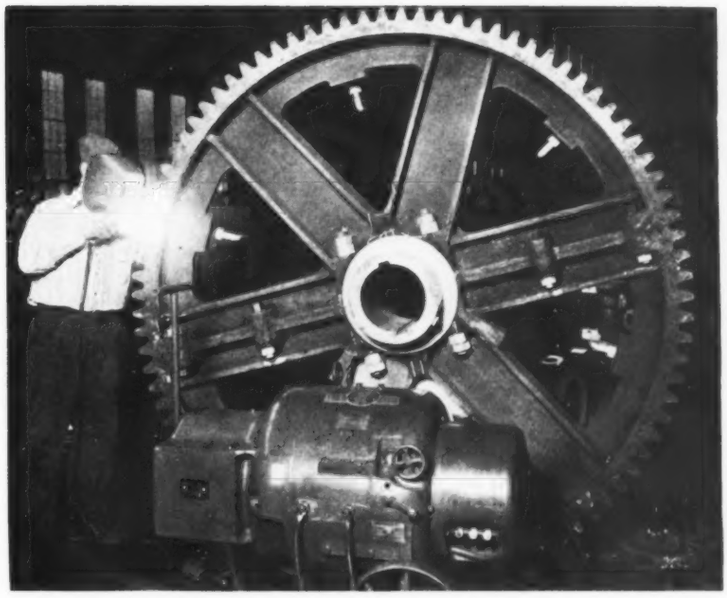
The interference with any beam can be used for various purposes, as, for example, sounding an outside bell or siren. In the demonstration, the system was also automatically connected to a telephone line, and, when the beam was interrupted, it dialed police headquarters and transmitted a spoken message, summoning aid. After this message had been repeated automatically for a minute and a half, the device "hung up" and then called the telephone company, repeating its message for the same period as a check on the first call. Having done this, it once more placed the telephone automatically back into regular service.

Since the invisible beams are sensitive to smoke as well as solid objects, the system could be arranged to automatically call the fire department.

To demonstrate the distance of transmission possible with the device, an invisible ray was projected from a window on the thirty-fourth floor of the General Electric Building to a window on the sixty-third floor of the R.C.A. Building in Rockefeller Center, a distance of about 1800 feet. Every time anyone passed his hand through the invisible beam, he caused a light in the R.C.A. Building to be turned on. Even a whiff of cigar smoke would light up a window several blocks away.



An 89-ton Steel Casting which Forms Half of the Bed Plate of a Forging Machine Built by an Eastern Manufacturer. The Casting is being Machined on a Large 14-foot Planer at the Allis-Chalmers Mfg. Co.'s Plant at Milwaukee, Wis. This Casting is 11 Feet High by 12 Feet Wide



This Illustration Shows an Interesting Case of Metallic Dentistry. When a Tooth Broke on This Large Gear, it was Quickly Repaired by the Use of a Westinghouse Arc-welding Outfit. The Gear is Part of a 300-horsepower Hoist at the Loomis Colliery of the Glen Alden Coal Co.

The automatic equipment used in such an installation is so small in size as to be almost unnoticeable. The system may remain operative even though the power lines to the premises should be cut or fail, since a battery supply of electricity can automatically be tripped in if the regular current should be interrupted.

Moving Executive Offices from Floor to Floor

According to an account of a new fifteen-story building erected to house the Bata Co.—the largest shoe manufacturer in Czechoslovakia—a unique method of keeping the executives in close touch with various departments has been introduced. It appears that an outstanding feature of the new structure is a peculiar elevator system for some of the executive offices. These offices, which are spacious rooms, in keeping with the positions of their occupants, can be raised and lowered to come opposite any floor in the building, so that any office can be placed in immediate contact with any one of the manufacturing departments.

Moving Loaded Overhead Cranes from One Bay to Another

A novel transfer system for moving loaded overhead cranes from one bay to another has been installed at the new Detroit plant of the American Blower Corporation. The installation consists of four units, two of which are standard overhead traveling cranes moving along the working bays, while the other two are transfer cranes which travel at right angles, along both ends of the building. Heavy machinery units in process of fabrication in the main working bays are lifted by the overhead cranes in these bays which travel to the end of the runway, where, through an ingenious arrangement, the entire cranes with their loads are picked up by the transfer traveling cranes moving at right angles, and are thus transferred to adjoining bays for the next steps in production.

The main bay cranes are 5- and 10-ton Pawling & Harnischfeger units, operating on runways 364 feet long, while the transfer cranes, each of 25-ton capacity, travel 120 feet across the ends of the building. Depressed railroad tracks, running below and parallel with the transfer crane runways, facilitate the loading and unloading of freight cars.

Largest Span Concrete Building in America

The new sports arena at Hershey, Pa., is the largest span concrete structure in America. It is rectangular in shape, 362 feet long and 232 feet wide, without a single pillar or column within that area. The sports arena seats 10,000 people. Strange as it may seem, Hershey is a town with a population of only 2500 people, but its sports center draws its support from an area with a radius of seventy-five miles.

World's Largest X-Ray Apparatus

What is said to be the largest X-ray apparatus ever built has recently been installed at St. Bartholomew's Hospital, London, England. The apparatus operates at 1,000,000 volts and weighs over ten tons. It produces rays more powerful than those obtained from ten grams of radium. The equipment is the result of four years of research at the works of the Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester, England.

EDITORIAL COMMENT

One of the most effective channels through which adopted industrial standards become generally known and used is the engineering handbook. Most engineers turn to the handbook in their field for information on standards that have been adopted by industry.

The frequent changes that are made in adopted standards present, however, a difficulty both to the users and the publishers of handbooks. It is obvious that if standards are frequently changed, obsolete standards are on record in a great many handbooks still in daily use. Some of the changes made in adopted standards are necessitated by industrial progress and development, requiring a revision of former ideas as to what a satisfactory standard should be; but in too many instances the changes have been made not because something new was available that was not known in industry when the original standard was adopted, but rather because the original standard was agreed upon either too hurriedly or without a full appreciation of all the known factors.

A Standard Depends Upon its Stability for its Value

When a standard has been approved, and published in tens of thousands of engineering handbooks, it becomes definitely established as a standard in the engineering mind. When changes are made, obviously information on the old standard will still be in the hands of many engineers. The result is a great deal of confusion as to what really is "standard."

The sum and substance of all this is that standards should only be proposed and approved after the most careful consideration, and after a study of all the available knowledge and experience, so that changes will be necessitated only in most unusual cases, where entirely new discoveries or practices in industry make changes imperative. The value of a standard depends upon its stability.

At frequent intervals the President and the Administration have suggested that industry ought to employ a larger number of men, thereby reducing the number employed by the PWA and other Government relief agencies. In urging industry to engage more men, two fundamentals are overlooked: First, that industry can employ only as many people as are required to make the amount of products that can be sold; and second, that millions of the workers employed on Government work and on relief are wholly unfitted for the work that is available in industry. They have received no training in the various trades to qualify them for industrial work. Many are, in fact, unemployable in industry.

Most Unemployment Due to Lack of Training for Industrial Work

In the machinery field, for example, there is a definite shortage of qualified machinists and toolmakers, in spite of the number of people classified as unemployed. Unfortunately, no effort was made to provide industrial training for the unemployed early in the depression. The need for such training was as great as the need for relief. There would have been jobs today in industry for many men who are still on Government relief rolls, had some of the Government expenditures been made for such training.

One of the most important facts facing not only industry but Government agencies is that the rehabilitation of millions of unemployed can be effected only by training them for the performance of useful industrial work.

Machine tool designers deserve a great deal of credit for the manner in which they have solved the problem of attractive appearance of machine tools. The modern machine tool is a remarkable achievement in artistic design, especially when one considers the fact that utility must always be the engineer's first consideration in the design of so utilitarian an object as a machine tool.

Appearance, as Well as Utility, in Design of Machine Tools

In many other fields, present-day designs appear to have gone astray, too much homage having been paid to novelty and the modernistic trend. The machine tool designer has side-stepped these pitfalls and has kept faith with the fundamental principle of all true art—that a design should be appropriate for the object to which it is applied. Beauty in machine design is just as desirable as beauty in architecture; but in each field *that* design is best which most truly harmonizes with the purpose to which it is applied.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Pivoted Swiveling Movement for Truing Formed Grinding Wheels

By ROBERT W. HUXTABLE

A device for truing small grinding wheels to the shape required for grinding flutes in taps and reamers has an interesting arrangement for guiding the wheel-truing diamond. This consists primarily of a cam-controlled pivoted lever mounted in a swiveling holder.

Referring to the illustration, the lever is pivoted on stud *A* in the holder or body *B* which can be swiveled on stud *C* by means of the handle *D*. The long arm *E* of the lever has a hardened steel follower at *F*, which is held in contact with the guide cam *G* by springs *H*, while the short arm *J* holds the wheel-truing diamond *K*.

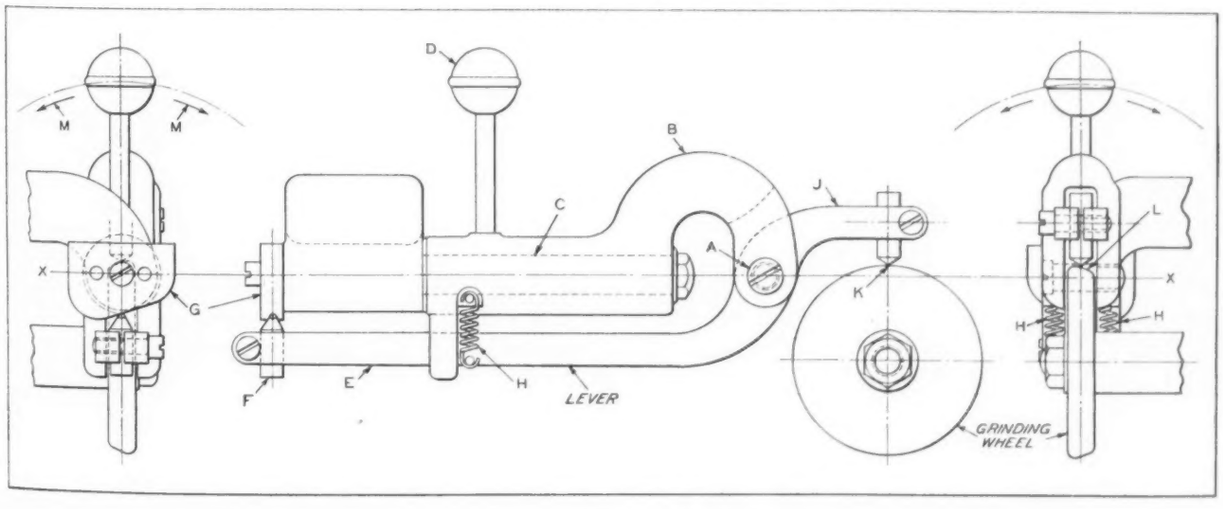
Cam *G* determines the form produced by the truing diamond. This cam has the same shape or form as that required on the grinding wheel, but it is made to a larger scale, the difference in size being in the same ratio as the lengths of the arms *E* and *J* of the lever. Thus arm *J*, being one-quarter as long as arm *E*, requires cam *G* to be four times as large as the corresponding formed portion of the wheel shown at *L*.

In operation, the handle *D* is swung back and forth through an angle of 180 degrees, the movements being in the directions indicated by the arrows *M* in the end view to the left. This oscillating movement causes the diamond at *K* to true the grinding wheel to the required shape. Wheels can be formed to different sizes and shapes by employing different guide cams *G*. The radius of the point of the cam follower *F* is proportionately larger than the radius of the point of the truing diamond in the same ratio as the lengths of the lever arms. The respective distances of the contact points of the follower *F* and the truing diamond *K* from their common center line *X–X* are also in the same proportion as the lengths of the lever arms.

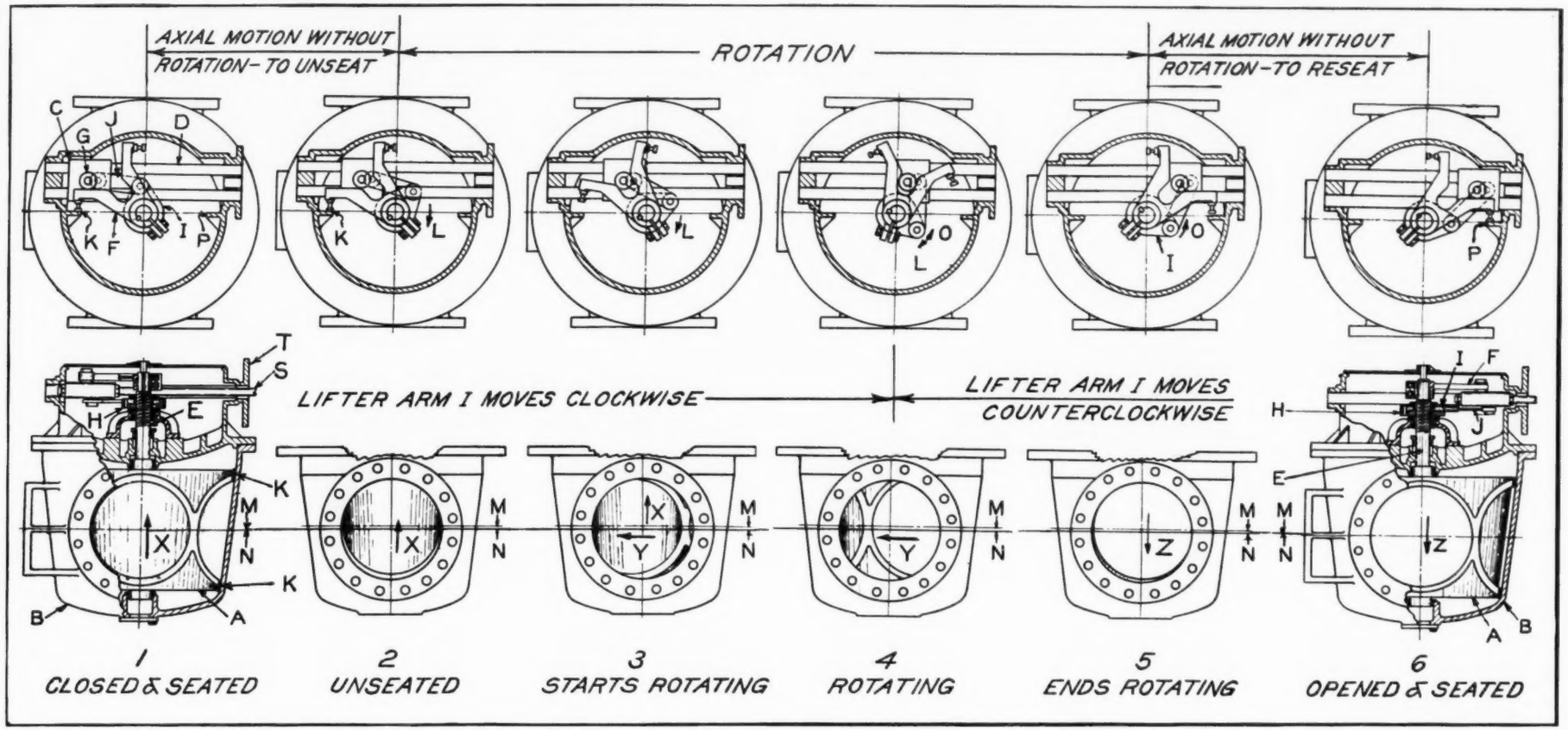
Mechanism for Obtaining Reciprocating and Rotary Motion from Straight-Line Motion

By A. R. KLIGMAN

The tapered closing plug *A* of the automatic valve here illustrated (see next page) is given three successive motions when changing from the closed to the open position, or vice versa. First the plug *A* must be raised from its seats *K*, or moved along its axis in the direction indicated by the arrow *X* in the view in the lower left-hand corner of the illustration. After being thus freed from contact with the seats in the casing *B*, plug *A* is rotated 90 degrees about its vertical axis on its central pivot bearings, as indicated by arrow *Y*. When rotation is completed, the plug is moved along its axis in the direction indicated by the arrow *Z* until it is reseated in the casing.



Pivoted Swiveling Lever and Large-scale Guide Cam Used for Truing Formed Wheel



Diagrams Illustrating Operation of Mechanism for Opening and Closing Large Plug Type Valve

This rather complex movement is imparted to the plug by a cross-head *C* connected to the piston *S* of a cylinder (not shown) which is bolted to the flange *T*. The cross-head *C* has a straight-line motion along guides *D*.

Starting with the valve plug *A* in the closed position, the fluid passageway being shut off and the plug seated as shown by View 1 to the left, the operation of the valve is as follows: During the first portion of the cross-head stroke, from the position shown by View 1 to that shown in View 2, the rotator arm *F*, attached to the stem *E* of plug *A*, is held in position between the roller *G* and the closing stop *K*, thus preventing any rotation of the plug while the lifter arm *I* begins its clockwise rotation, as shown by the arrow *L*. Rotation of arm *I* is obtained through the link *J* which connects it with the cross-head *C*. Arm *I* is connected to nut *H* on the threaded part of stem *E* of plug *A*. As nut *H* has no vertical movement, its rotation by arm *I* causes the plug *A* to be raised from its seats *K*, its center line *M* being moved away from the center line *N* of the casing *B*.

Continued movement of the cross-head starts the rotator arm *F* and plug *A* turning in a clockwise direction, as indicated by arrow *Y*, through the action of roller *G*. The rate of turning being higher for the lifter arm *I* than for the rotator arm *F*, there is an additional movement of the plug in the unseating direction indicated by arrow *X*, as shown by a greater spread between the center lines *M* and

N in View 3. This additional movement of the plug takes place at a decelerating rate.

As link J approaches a position at right angles to the cross-head path (see View 4) the conditions change so that instead of moving ahead of or at a faster rate than the rotator arm, the lifter arm I slows down. Thus the axial movement of the plug, as indicated by the spread between lines M and N, is not only checked but gradually and very slowly reversed, as indicated by arrow Z, View 5.

Beginning with the position shown in View 4, the arm I starts to rotate in the direction O, that is, it tends to "meet" the rotator arm F, with the result that the plug is moved downward in the direction Z at the same time that it is turned about its axis in the direction indicated by arrow Y. Rotation of arm I in the direction O reverses the rotation of nut H, causing the plug to move downward. This downward movement is accelerated by the turning of the threaded stem in a clockwise direction by arm F.

By the time the members of the mechanism have reached the positions shown in View 5, the rotator arm F and the plug A have turned through an angle of 90 degrees into the open position, arm F has come in contact with the opening stop P, and the spread between the lines M and N is the same as it was in the position shown in View 2 at the beginning of the rotational movement.

During the last portion of the cross-head stroke, the rotator arm F is held stationary between the roller G and stop P while the lifter arm I continues its movement in the direction indicated by arrow O. The plug is thus given an axial movement only, in the seating direction Z, and the valve then presents a fluid passageway which is equal to the full size of the pipe, as indicated in View 6.

The return stroke of the cross-head in the closing direction simply reverses the opening cycle movements. An important feature of this valve-actuating mechanism is its smooth operation and the total absence of abrupt or sudden changes in the movements of the parts. The mechanism described has been applied successfully to very large units, in which valve plugs weighing several tons have been operated in a few seconds.

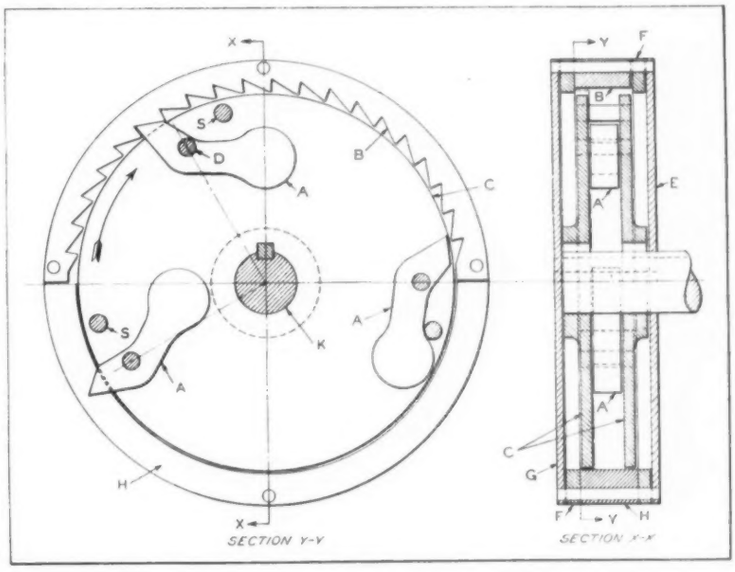
Noiseless Ratchet Mechanism for Preventing Reversal of Shaft

By J. J. VAN VECHTEN

The ratchet mechanism shown in the accompanying illustration was designed for noiseless or silent operation, and was originally intended for use on the head-shaft drive of belt conveyors, where a peripheral speed of 100 or more feet per minute is attained. However, it could easily be adapted to other uses where it is desirable to prevent a shaft from turning backward.

The mechanism is very simple, centrifugal force being utilized to keep pawls A from contact with the ratchet teeth B while the rotating member C is in motion. Member C is keyed to the shaft K. The instant C stops rotating, one of the three pawls A engages teeth B, preventing shaft K from rotating backward. When forward motion of the shaft is resumed, the pawl is instantly thrown out of contact with the ratchet teeth, the outward motion being restricted by stop-pins S.

The rotating member is composed of two identical plates C, as shown in the cross-sectional view to the right. The three pawls A are suspended between plates C in such a way that they are free to swing on their pivot pins D while the member C rotates in a forward direction. The ratchet teeth B are cut in a 180-degree segment mounted in the upper half of a dust-tight housing, the segment being held fixed between plates E, F, and G. The inner plate E is attached to the frame of the mechanism. The part H occupies the same relative position between the plates in the lower half of the housing as that occupied by the ratchet-tooth segment in the upper half.



Silent-operating Ratchet Designed to Prevent Shaft from Rotating in Reverse Direction

* * *

The railroads of the United States carry annually about 750,000 carloads of materials and products on behalf of the manufacturers of motor vehicles and parts. Hence the automobile returns to the railroads a considerable portion of the traffic that in other directions it may have taken away from them.

Building Accuracy

Machine Tool Building Calls for Far Greater Accuracy Today than in Years Past Because of New Cutting Materials and Closer Manufacturing Tolerances

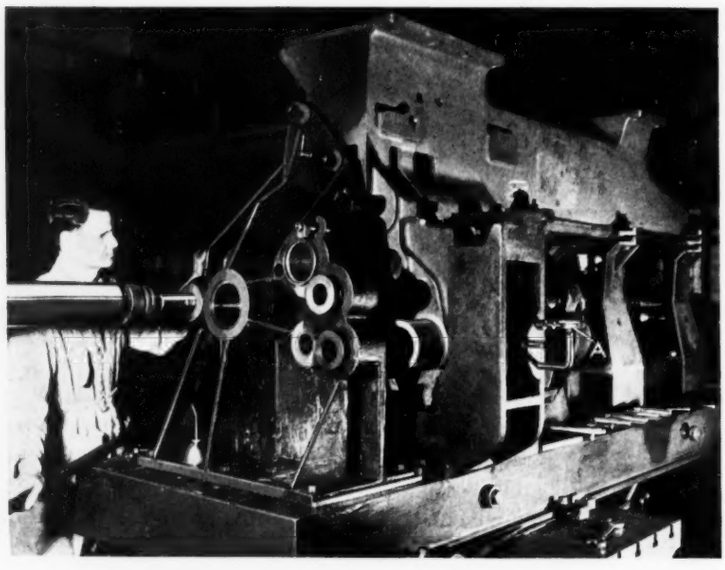
Fig. 1. Checking a Turret Lathe Bed for Parallelism and Straightness of Ways with a Fixture Having Spirit Levels that Indicate Any Error, Lengthwise or Crosswise

MACHINE tool building has entered upon a new phase. A few years ago spindle speeds of several hundred revolutions per minute were plenty fast enough. Today spindle speeds of several thousand revolutions per minute are frequently demanded. Machine beds must be far more rigid than in former years, in order to permit heavier cuts at the higher speeds, and this has led to better design and the use of improved cast irons and semi-steels. Increased speeds and the desire to eliminate noise have led to wider application of ball and roller bearings. Gears are made from tougher alloy steels, are hardened, and are ground in the teeth.

Many of these advances in machine tool construction resulted directly from the advent of tungsten carbide and other cutting materials developed during recent years. But another factor of considerable importance has been improved machine shop practice. Twenty years ago machine tools were built more accurately than they had to be for probably 90 per cent of their users. Today, even though machine tools are being manufactured to much closer tolerances, prospective buyers invariably need machines of highest quality in order to manufacture their products within the specified limits.

What is true of machine tools in general is applicable to the building of turret lathes. Extreme care is essential during the manufacture and assembly of turret lathes, in order to insure that the finished machines will perform to the guaranteed accuracy. This article will describe some of the methods employed by the Warner & Swasey Co., Cleveland, Ohio, to attain that objective.

Fig. 2. The Various Holes in the Headstock of Turret Lathes are Bored to Accurate Center Distances by Employing Jigs which Guide the Boring-bars on Both Sides of the Headstock



The head and bed of these turret lathes consist of a one-piece casting, which is first planed on the bed ways and on the bottom of the pedestal feet. Then the headstock is completely bored on a horizontal boring mill while supported and located from the machined bed ways. In this operation, jigs, such as seen in Fig. 2, are used to insure that the various headstock holes are bored to specified center-to-center distances

into Turret Lathes

This Article Describes Some of the Exacting Methods Used by the Warner & Swasey Company in Building Turret Lathes—First of Two Articles

parallel to the ways. Holes that extend through both the front and back walls of the headstock are line-bored.

All holes are rough-bored to within about 1/32 inch of the finished size, after which the casting is removed from the machine for certain other operations. It is then brought back to the boring mill for finish-boring all holes, with the exception of the seats that are to support the Timken bearing races for the spindle. It was found to be good practice to set up the casting twice on the boring machine, first for roughing and then for finishing the holes. Single-bit cutters mounted on long bars are employed for both roughing and finishing.

The bearing surfaces for the spindle Timken bearing races are rough-bored and semi-finish-bored on the boring mill to within about 1/32 inch of the finished diameter. Several holes are tapped while the casting is on the boring mill and the drive-shaft bearings are line-reamed. The large boring-bar used for the spindle bearings is kept permanently on the machine, being supported on roller stands in line with the corresponding guide holes in the jigs when not in actual use.

At *A* in this illustration may be seen an indicator which bears against one side of a clamp used to hold the casting in place. From this indicator, the operator can tell whether the casting shifts during the various cuts. This indicator also prevents clamps from being tightened so much, in setting up, as to spring a casting excessively.

Expensive jigs have been eliminated for boring aprons and some other castings by equipping horizontal boring mills with indicators on the table and the machine column. Bar gages are applied between these indicators, and stops are mounted on the bed and spindle head, in order to locate the work for accurately boring the various holes to the specified center distances. In Fig. 4, table indicators may be seen at *A* and *B*, a stop at *C*, and a bar gage at *D* between one of the indicators and the stop.

The indicators on the table are used

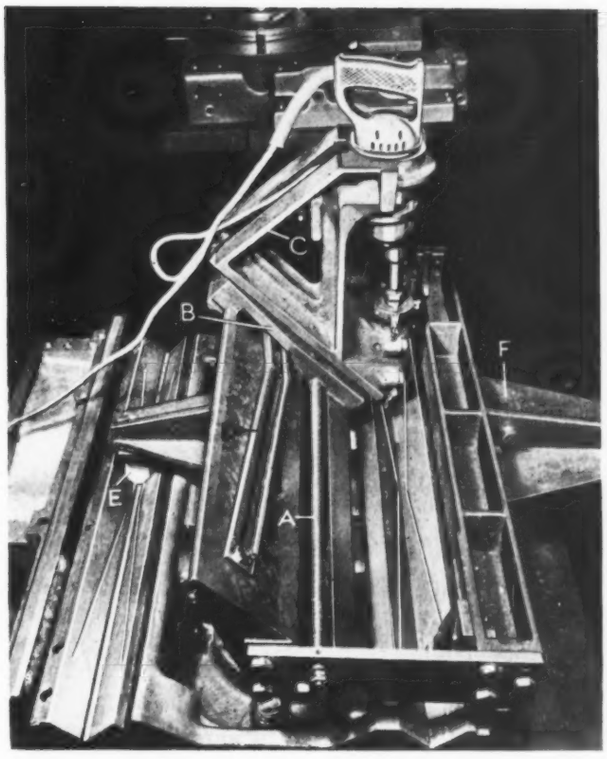
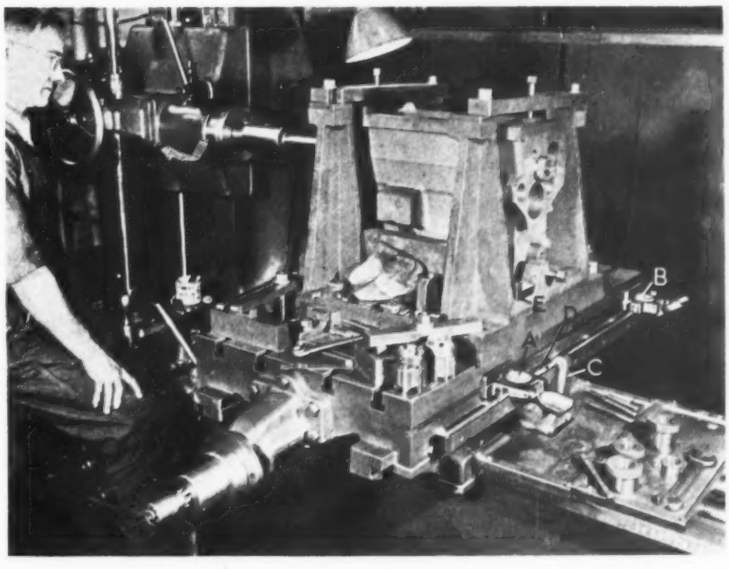


Fig. 3. X-Type Grooves are Milled in the Vees of Turret Lathe Saddles by Means of this Self-contained Portable Outfit, which Includes a Portable Electric Drill

Fig. 4. Apron Castings are Bored on Horizontal Boring Mills Equipped with Indicators on the Table and on the Column for Obtaining Accurate Center Distances by the Use of Bar Gages



in making accurate transverse adjustments of the work, and the indicators on the upright in making vertical adjustments. The indicators read to 0.001 inch. They are set to zero at the beginning of each operation.

On trays at the right of the table may be seen several bushings which are used to support piloted tools. The simple fixture in the particular operation illustrated is used merely for locating and clamping purposes, the casting being located by seating a planed surface along the hardened and ground L-shaped bar *E*. Although this method of accurately boring a series of holes to specified center distances requires somewhat more time than if jigs were used, the saving in investment more than compensates for the greater time.

Accurate Bed Ways Are a Prime Necessity in Turret Lathe Manufacture

The surfaces of the various parts upon which the accuracy of the work depends are finished with the parts mounted on the turret lathe on which they are to be used. These finishing operations are performed on the assembly floor. The first operation in this department is to carefully "level up" the head and bed casting and then hand-scrape the bed ways until they are parallel and straight with respect to each other throughout their entire length. This is determined by means of the fixture shown in Fig. 1, which is equipped with two spirit levels, positioned at right angles to each other. One of these levels indicates whether the ways slope in the lengthwise direction as the fixture is slid along the bed, while the other shows any crosswise slope. The levels are graduated to 5 seconds.

The vee along the rear side of this fixture is in a floating block which is free to follow any changes in the distance between the ways. To make certain that the width across the ways does not vary, a micrometer is attached to the front and rear sides of the leveling fixture and readings are taken at various points along the bed. The illustration shows such an inspection being performed.

When the bed ways have been scraped to the required accuracy, seats are bored in the headstock to receive the outer races of the Timken roller bearings in which the spindle is to run. This operation is performed by means of a portable self-contained unit which is seated on the bed ways, thus insuring that the spindle bearing seats will be in line with the ways. The front bearing seat is finish-bored and the Timken bearing assembled before the rear bearing seat is bored. In this last operation, the boring-bar is piloted in the Timken bearing.

Cutting X-Type Oil-Grooves in the Saddle Vees

To insure adequate lubrication between the saddle and the bed ways, X-type oil-grooves are cut in the saddle vees. They are produced by means of the equipment illustrated in Fig. 3, which is mounted on an upturned saddle, as shown. In the operation, an end-mill driven by a portable electric drill is adjusted to the desired depth of cut by means of a micrometer collar. Then by turning a handle at the far end of the fixture, lead-screw *A* is revolved to feed slide *B* lengthwise along the saddle. As this slide moves along the saddle, head *C*, on which the portable electric drill is mounted, moves in and out, producing the desired path of the groove. This is effected by means of a roller on the under side of head *C* which engages the cam path of bars *D*.

The fixture is located properly on the saddle by means of a V-finger *E*, which is entered into the saddle vee opposite the one being grooved. There is a similar finger on the outer end of arm *F* which is used to locate the fixture in cutting the opposite oil-groove in the right-hand surface of the saddle vees. These locating fingers are directly in line with the end-mill that cuts the grooves.

The second installment of this article, to be published in August, will deal with additional machining methods and with the final inspection.

* * *

Carborundum Radio Band to Play at Great Lakes Exposition in Cleveland

The well-known Carborundum band of sixty men, which has been heard over the radio for eleven years, has been invited to appear at the Great Lakes Exposition in Cleveland to play at two concerts during the afternoon and evening of July 24, which day will be known as Carborundum Day at the Exposition. The concerts will be given in the immense band shell in what is known as Radioland. It is expected that one or both of the Carborundum band programs will be broadcast. Francis D. Bowman, advertising manager of the Carborundum Co., who has arranged, produced and announced the Carborundum radio programs since their inception, will be at the microphone.

* * *

There is No Other Way

The prosperity and security of all the people in this country have come and can come only out of the work they do. The amount of prosperity and security they can have at any time depends solely upon the combined effort of mind and muscle which they are willing and able to apply in using the natural resources of the country to produce the necessaries and comforts they consume and exchange, and the tools and machines they need in order to produce as much or more in the future. The more work everyone does, the more people there are who work, and the harder and longer and more effectively they work, the more prosperous and secure they will be. There is no other way.—*Virgil Jordan*

Estimating Time Required for Machining

An Outline of the Methods Used at the East Pittsburgh Plant of the Westinghouse Electric & Mfg. Co. for Determining Time Required for Machining Operations

IT is frequently believed that, in shops engaged in the manufacture of a variety of products, rather than in the mass production of a few specialized lines, it is not possible to determine the required machining time in advance with sufficient accuracy so that it may be used as a basis for setting piece-work rates. This, however, is not altogether true. In larger plants especially, where there is a sufficient amount of work to warrant the making of accurate time studies, it is possible to determine the time required for a number of details that, taken together, comprise the entire operation; and on this basis, the time required for machining a great number of different parts may be estimated.

At the East Pittsburgh plant of the Westinghouse Electric & Mfg. Co. very complete time studies have been made, so that it is possible to determine in advance, with considerable accuracy, how long it will take to machine a casting or forging, even though a piece of that particular size or shape may never have passed through the shop before. An outline of how this is done is given in the present article.

We will assume that we are dealing with the data that has been collected and placed on record relating to work on 36- to 120-inch boring mills, covering boring, facing, and turning operations. First, a thorough analysis is made of each step or detail operation that may be required in the machining of a part on a boring mill. Such a list of operations, for example, would read as follows: Get job drawing and time slip; get tools and gages from tool-room; locate part; get air hoist; hook on part; raise and place part on table; release chain; get chuck jaws, place and tighten; get and place parallels; study drawing; adjust chuck jaws; true up part; get bolts, fillers, blocks, and clamps; place and tighten clamps; get driver; place and tighten driver—and so on until every step has been listed that must be taken in order to machine a part on the boring machine.

Then time studies are made and the time allowed for each of these operations, for different sizes of boring mills, is tabulated. Part of such a tabulation is indicated in Table 1, all time being expressed as decimals of an hour.

The time required for such operations as the truing up of the part, and for the actual machining, will vary with the part being machined. To estimate these time factors, curves and tables have been provided, from which the time may be read off directly. These curves and tables are based on accurate time studies. The curve or diagram for estimating the time required for truing up a part, for example, has listed at the bottom the diameter of the work, in inches. Following a line from these inch graduations upward to the curve, and then horizontally toward the left of the diagram, we read off directly the time required in decimals of an hour.

The tables covering machining time are arranged like the example shown in Table 2 where, when the depth of cut, speed S, and feed F are known, the machining time allowance per inch of the length of the cut, per inch of the diameter to be machined, is read off directly in column C. From this, the total machining time for any diameter and length of cut is easily calculated. These tables cover all materials, such as cast iron, cast steel, hot-rolled steel forgings, nickel and vanadium steels, and include ordinary high-speed steel and Circle-C steel—for cuts both with and without lubricant, and for continuous or intermittent cuts. Obviously, these tables occupy considerable space. In fact, those prepared for boring mills alone include twenty-two tabulated arrangements similar to Table 2.

For calculating the machining time, the following formula may also be used:

Table 1. Part of Tabulation of Time Allowed, in Hours, for Performing Operations Incident to Boring Mill Work

Operation	Size of Boring Mill, Inches			
	36 to 42	48 to 60	72	96 to 120
Get job drawing and time slip	0.1000	0.1000	0.1000	0.1000
Get tools and gages from tool-room	0.1200	0.1200	0.1200	0.1200
Locate part	0.0044	0.0044	0.0044	0.0044
Get air hoist	0.0040	0.0040	.....	.....
Hook on part	0.0048	0.0107	0.0107	0.0107
Raise and place part on machine table	0.0173	0.0253	0.0253	0.0379
Release chain	0.0029	0.0029	0.0050	0.0050
Get chuck jaws, place in position, and tighten	0.0242	0.0242	0.0242	0.0242
Get parallels and place in position	0.0086	0.0086	0.0086	0.0086
Study drawing	0.0187	0.0187	0.0187	0.0187
Adjust chuck jaws—per jaw	0.0064	0.0064	0.0064	0.0064

Table 2. Example of Table Giving Unit Time for Boring Mill Operation

Cast Iron—Continuous Cutting—High-Speed Tools									
Depth of Cut, Inch	36 to 42 Inches			54 to 60 Inches			72 to 120 Inches		
	S	F	C	S	F	C	S	F	C
1/8	47.5	0.080	0.00135	47.5	0.109	0.00099	42.5	0.250	0.00049
1/4	45.0	0.080	0.00143	47.5	0.083	0.00122	45.0	0.125	0.00091
3/8	45.0	0.062	0.00182	47.5	0.068	0.00159	47.5	0.094	0.00115
1/2	42.5	0.062	0.00192	45.0	0.068	0.00167	45.0	0.094	0.00121
5/8	40.0	0.062	0.00204	42.5	0.068	0.00177	42.5	0.094	0.00128

$$T = 0.01955\ N\ \frac{L\pi D}{FS}$$

in which

T = time, in hours;
L = distance or length to be machined, plus 1/2 inch;
D = diameter to be machined, in inches (when calculating a facing operation, use mean diameter);
F = feed per revolution, in inches;
S = peripheral speed per minute, in inches; and
N = number of cuts that must be taken to remove required amount of material.

The constant 0.01955 represents one-sixtieth of an hour (one minute) plus an additional allowance of 17 per cent.

This briefly indicates how a system can be developed for estimating the time required for machining miscellaneous work on various types of machine tools. Obviously, a great deal of time and care is required in preparing the data outlined. Extensive time studies must be made and every step in the operation listed separately and the time required for it recorded. When a plant is sufficiently large, however, to warrant doing this, it is easy to estimate the time required for performing any machining operation, even though the parts being machined are entirely new to the shop.

Casting Steel in Cement-Bonded Sand Molds

AT the recent annual meeting of the American Gear Manufacturers' Association, H. F. Scatchard of the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., described the general principles and advantages of what is known as the Randupson process for casting steel in cement-bonded sand molds. This process of molding differs essentially from the ordinary dry sand process in that the drying of the mold is not effected by evaporation of the moisture, but by a definite chemical reaction.

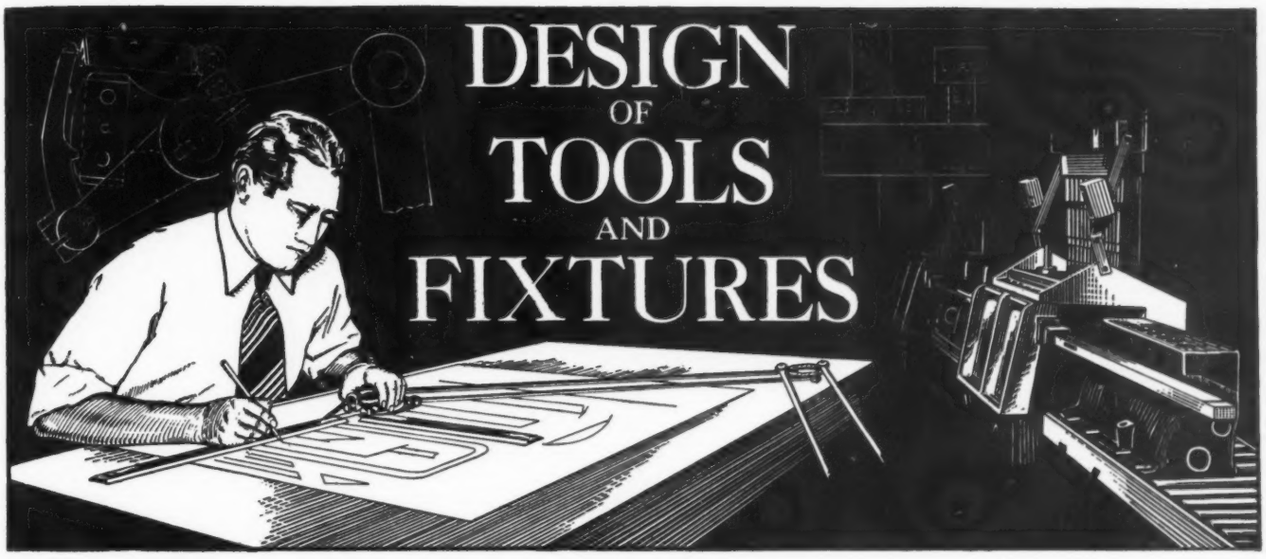
All natural, as well as artificial, bonds in general use for molding sands have a fusing point considerably below that of the sand itself, and also below the pouring temperature of the molten metal. Naturally, when the metal comes in contact with the bonds, they disintegrate into their component gases, and to get rid of these gases is one of the difficult problems in foundry practice. The making of molds of cement, sand, and water alone has overcome this difficulty. Although cement has a somewhat lower fusing point than sand, there are practically no gases generated when the molten metal comes in contact with the cement facing.

It should be understood that the process is not a permanent mold process. The mold is completely destroyed when the castings are shaken out, just the same as in ordinary molding. There have been a few exceptions to this rule. One company using the process for ingot molding reports that it has used the cement molds five or six times.

Among the advantages claimed for this process is the production of castings true to patterns, because of the greater rigidity and hardness of the molds. In castings such as large gear-cases, the difference in flatness of the sides and truth of the ribs between those made by the Randupson process and those made by the usual methods is striking. Another important feature of the process is that there is no need for mold and core reinforcement. Owing to the inherent strength of the mold and core, almost no rodding or setting of gaggers is required. There is likewise an almost total elimination of surface nailing. Flask equipment has been largely done away with. Elimination of oven drying is also an outstanding advantage.

The question is often asked: "What shrinkage allowance is required in the patterns when using this process?" There is no change whatever in the allowances made in the patterns, as compared with conventional practice. In pattern construction for the Randupson process, it is highly desirable to keep mold or core sections as simple as possible. It should also be mentioned that facing for the Randupson process does not lift well; hence the patterns should be drawn.

Often pattern costs can be reduced considerably. For instance, for gears, solid patterns are not desirable. If symmetrical about the hub, a one-piece half-pattern or even an eighth-pattern materially reduces the cost, and, if necessary, interchangeable hubs can be used.

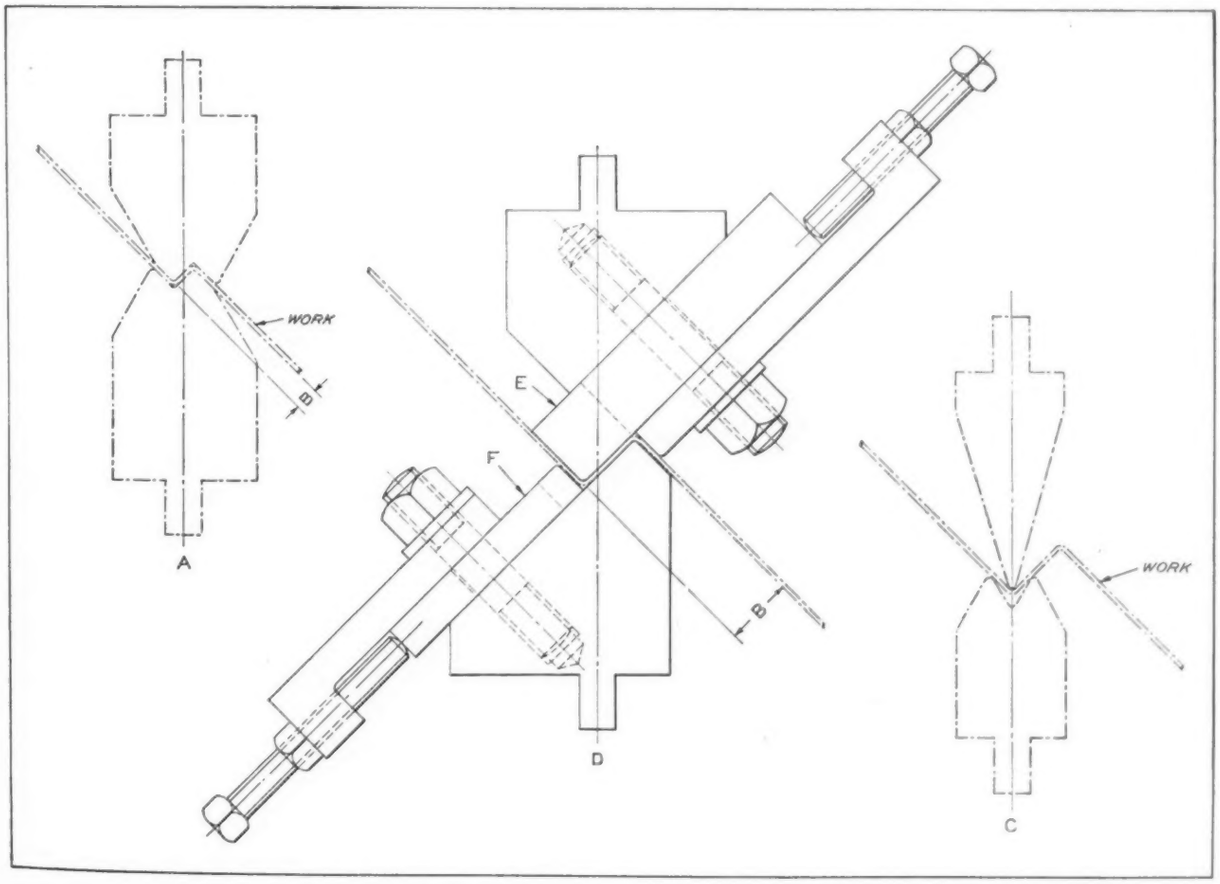


Universal 90-Degree Double Brake Die

By NORMAN S. GABLE, Allentown, Pa.

Three types of brake dies for making bends in sheet metal are shown in the accompanying illustration. The type shown at *A* is limited to the production of double bends of one size only; that is, the amount of offset *B* is always the same for each die. Thus, with dies of this type, a separate die is required for each size offset. The die shown at *C* makes only one right-angle bend at each stroke, and although it can be used to make double bends of any required offset, two strokes of the die are necessary to complete a double bend.

The desirable features of both of these dies have



Brake Dies for Making Right-angle Bends in Sheet Metal

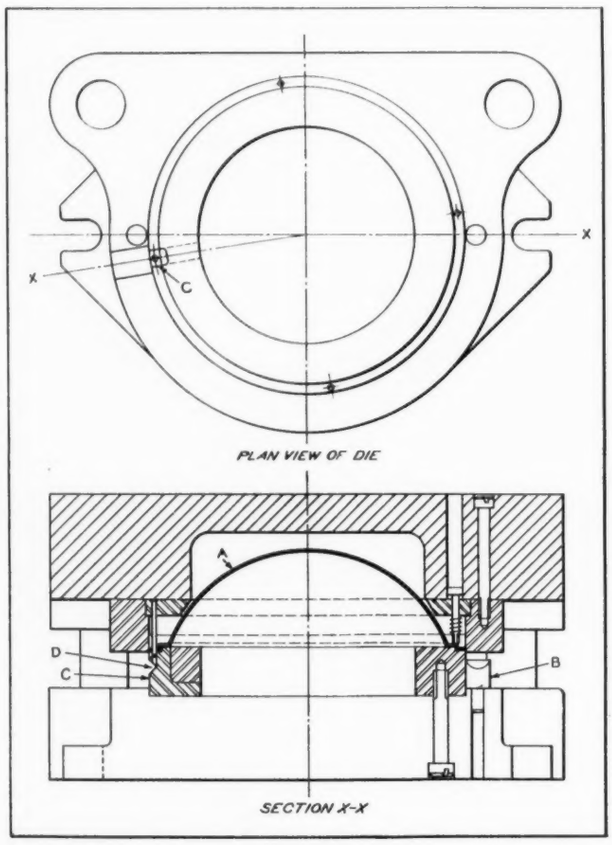
been combined in the 90-degree universal double brake die shown at *D*. The plates *E* and *F* of this die are adjustable and reversible, and can be set for producing double 90-degree bends for a given amount of offset *B* from 1/4 inch to 2 inches. Dies of similar design can, of course, be made to cover a different range of offsets.

Inserts for Piercing Die Prove Advantageous

By JOHN J. McHENRY, Detroit, Mich.

The compound die shown in the accompanying illustration is the conventional design employed for trimming and piercing certain types of reflector shells *A*. It is provided with the usual chisels *B* for cutting the rim scrap, and needs no detailed description. The feature of interest, however, is the use of inserts in the lower die wherever holes are to be pierced. One of these inserts is shown in detail at *C*. Although not shown, there are as many of these inserts as there are holes to be pierced. The inserts are a close fit in the slots cut through the side and across the bottom of the lower die ring, as indicated at *C*.

A V-slot *D* is milled across the outer edge of each insert to provide an outlet for the pierced slugs. Previous to this method of removing the slugs, slots were cut across the bottom face of the die-shoe, into which the pierced slugs would drop and through which the press operator would poke out the slugs at intervals. This resulted in frequent breakage, because the operator sometimes allowed the slugs to pile up too high. As the wall thickness between the hole and the outer edge of the die ring was only 1/32 inch, hardening of the solid type of die occasionally resulted in breakage at this point. The inserts, being comparatively small, can be hardened without trouble, and even when breakage does occur, they are easily and quickly replaced.



Die for Trimming and Piercing Reflector Shell

Welded Fixture for Grinding Planer Knives

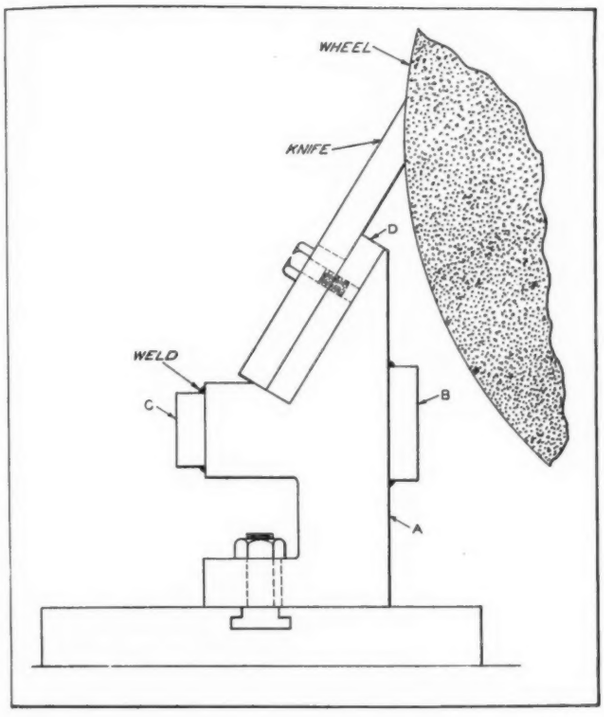
By LIONEL BOUDREAU, Putnam, Conn.

Nearly every machine shop and plant maintenance department has occasion to grind the knives of woodworking planers. Many shops, however, do not have a sufficient amount of this work to justify the purchase of equipment designed especially for grinding planer knives. Improvised means for handling such jobs is usually inefficient and unsatisfactory. To overcome this difficulty, a simple welded fixture of the design shown in the accompanying illustration was constructed which has been in use for over a year with satisfactory results. This fixture can be mounted on the table of a cylindrical grinder or on a planer equipped with a grinding attachment.

If it had been a question of making a pattern or a casting, the idea of making the fixture would very likely have been sidetracked. By employing welded steel construction, however, a fixture of low cost weighing less than one-third the weight of a cast-iron fixture was produced. Only the end view of the fixture is shown, as the longitudinal members are simply straight pieces of the required length.

The grinding wheel employed should be 12 to 14 inches in diameter and have a face width of not less than 1 inch. The wheel should be of medium grade and open grain. More than the average amount of coolant should be directed on the wheel to avoid overheating the work. The fixture consists of three identical members *A*, two being used for the ends and one for the center support. After machining these members simultaneously and milling open slots in the bases for the fastening studs, the end pieces were aligned for welding the plates *B* and *C*. The plate *D*, after being drilled and tapped for the knife-holding screws, was welded in place.

The fixture thus constructed is very rigid, easily handled, and is adjusted in relation to the wheel-slide by clamping the indicator to the grinding wheel and contacting the bevel edge of the knife. The concavity resulting from this method of grind-



End View of Fixture for Grinding Planer Knives

ing permits the knife to be easily stoned to a keen cutting edge. No detrimental effect on the life or performance of the knives is noted as a result of the slight curvature produced by grinding the cutters in the manner illustrated.

Method of Chucking Work for Cross-Holes

By WILLIAM S. ROWELL, Wilkinsburg, Pa.

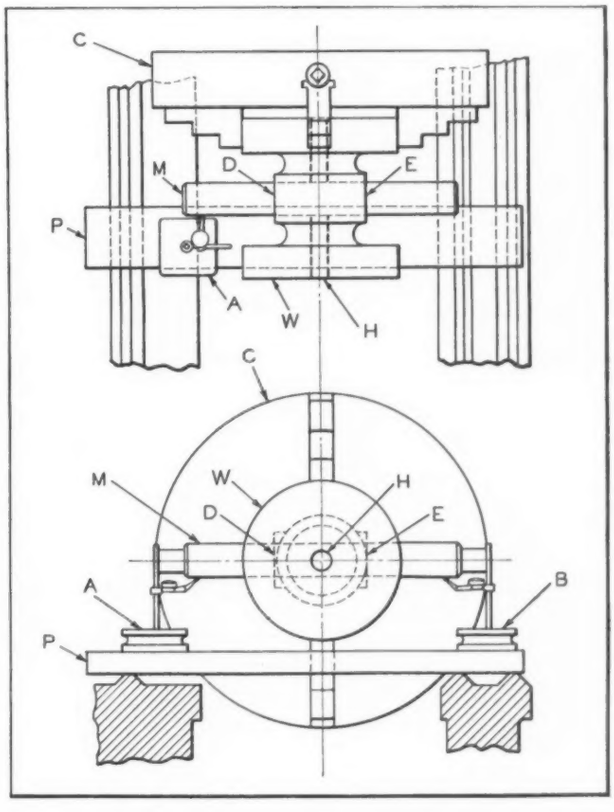
Lathe chucking for a cross-hole in the same plane and at a given angle from an existing bore, when a fair degree of accuracy is required, is not easy. The accompanying illustration shows one method of handling work of this kind. A plan view of the lathe chuck *C* is shown in the upper view, together with the work *W*, the mandrel *M*, and the indicator *A*. The mandrel fits the first bore without shake, and the ends project far enough to provide for the use of an indicator as shown. The mandrel must be straight and its projecting ends must be the same diameter within accurate limits. If the mandrel is an expander type, its removal without shifting the work in the chuck is greatly facilitated.

Plate *P* may be any convenient piece having plane, parallel and accurate surfaces, a ground shear blade such as illustrated being suitable for the purpose. When the work is set with the mandrel approximately parallel with the faceplate, the indicator is set up as shown and the lathe spindle and chuck turned over by hand, shifting the work in the chuck until the indicator reads the same for each end of the mandrel.

Now with the mandrel approximately parallel with plate *P*—see lower view—the contact point of the indicator *A* is passed either over or under each end of the mandrel. The spindle is then shifted until the indicator shows the same reading at both ends of the mandrel. The readings should be taken about the same horizontal distance from the lathe center on both ends of the mandrel. The greater this distance, the more accurate would be the results. After noting the indicator reading, the lathe spindle is revolved one-half turn. New readings are then taken in the same way and the work shifted in the chuck one-half the difference between the first and second sets of readings.

To position hole *H* properly in relation to faces *D* and *E*, the indicator is mounted in the toolpost. With the work in the position shown—that is, with the mandrel about parallel with plate *P*—the indicator is brought into contact with face *D* near its horizontal center. The work and spindle are then very slightly rotated back and forth, and the lowest reading of the indicator noted. The reading on the graduated collar of the cross-feed screw is also noted. The indicator is then traversed back far enough to clear the face *D* and the spindle rotated one-half turn, after which the indicator is fed forward again to make contact with the face *E*.

If, when the spindle is slightly rocked or rotated back and forth, the indicator gives the same



Diagrams Illustrating Method of Chucking Work for a Cross-hole

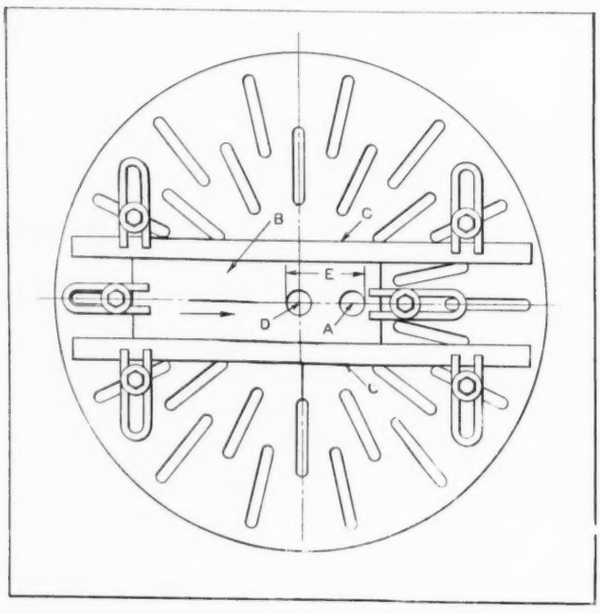
low reading with the cross-feed screw graduation at the same position, the center of hole *H* will be half way between the faces *D* and *E*. Assuming that the other settings have been properly made and retained, the center of hole *H* will now be in the same plane as the center line of the first hole and at an angle of 90 degrees with the first hole.

Machining a Progressive Die-Block in the Lathe

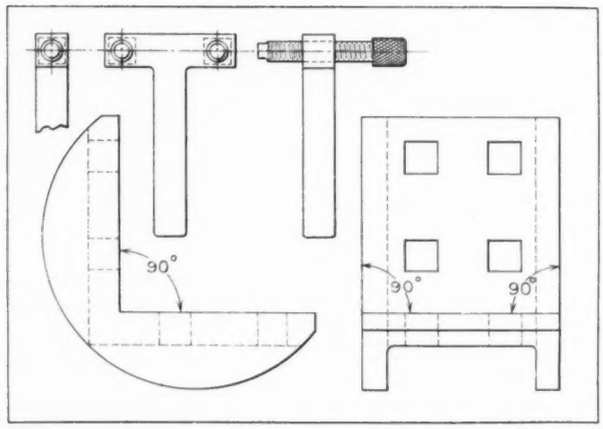
By ALBERT A. CAVICCHI, Arlington, Mass.

In machining a progressive die-block that is to have inserted tools, great care must be taken to have the station recesses accurately spaced and located in a straight line. Referring to the illustration, the first step is to prick-punch the location of the first station at *A* on the die-block *B* and fasten the die-block to the faceplate of an engine lathe, locating it so that the punch mark will run true. A parallel bar *C* is then fastened to the faceplate on each side of the die-block. These parallel bars guide the die-block in a straight line when it is relocated for the machining operation at the next station *D*.

After the hole at the first station has been machined to size, the die-block is moved the required distance in the direction indicated by the arrow. When the hole at the second station has been machined almost to size, the distance *E* is measured. One-half the diameter of the hole at each station is subtracted from this measurement to obtain the center-to-center distance. If the station is not spaced accurately, the die-block can be easily moved for correction. This procedure is followed until all the stations have been machined.



Set-up for Machining Recesses in Progressive Die-block



Fixture and Screw Clamps for Holding Small Parts

Fixture for Holding Small Pieces Square with Chuck or Machine Table

By GEORGE WILSON, Marshalltown, Iowa

The fixture shown in the accompanying illustration is designed for holding small pieces that are to be ground or drilled square with a certain side or face. It is especially useful where a magnetic chuck is employed. The fixture has two clamping faces located at right angles to each other and flanged sides of circular shape which permit using an indicator for aligning the fixture on a lathe faceplate.

Pieces of irregular shape can be clamped to the fixture with screw-jacks of the type illustrated, which have square shanks that fit into the square holes in the work-locating plates. A double screw-clamp and a single screw-clamp are shown in the upper left-hand corner of the illustration. The fixture is machined from a gray-iron casting and the clamping jacks and screws are made of steel.

* * *

Opportunities for Advancement in the Machine Industries

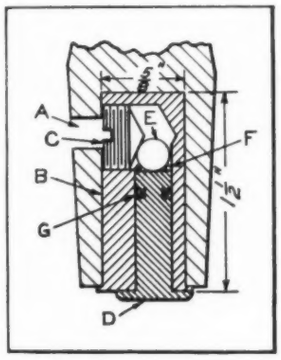
In the annual report of the Link-Belt Co., the president, Alfred Kauffmann, mentions that a recent survey was made in the company's various plants covering the length of service of the principal officers and executives who had started at the bottom and who are now in managerial positions in the company's eight plants. It was found that seventy of these men had started from minor positions, having been in the company's employ an average of twenty-seven years each. Of these seventy men now holding managerial positions, twenty-one started in the drafting-room, twenty-one came up through the shop, and twenty-eight started as office boys and clerks. Mr. Kauffmann stated that, in his opinion, this is an answer to the question as to whether there are opportunities for advancement in industry today.

Ideas for the Shop and Drafting-Room

Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work

Self-Locking Machine Leveling Supports

The device shown in the accompanying illustration was designed to provide a convenient means for leveling up tables and small machines or other equipment. Its installation in the end of a table leg or any other supporting member requires only the drilling of two holes —a 5/8-inch vertical hole to a depth of 1 1/2 inches, and a small side hole *A*, as indicated. The casing *B* of the device is driven into the 5/8-inch hole with the adjusting screw *C* located opposite hole *A*. The supporting pin *D* can be adjusted downward as required to level up the table or other equipment by simply turning screw *C* with a screwdriver inserted through hole *A*.



Self-locking Leveling Support for Machines or Tables

The vertical adjustment of pin *D* is obtained by the downward thrust imparted to it by the ball *E*, which is forced downward by the conical end of screw *C* when the latter is turned inward. The three-point contact of the ball provides a self-locking feature, and any turning movement of pin *D* has no loosening effect on screw *C*. A split expansion ring *F* prevents the ball from dropping out should pin *D* be withdrawn. Another expansion ring or collar at *G* prevents pin *D* from dropping out. Although the adjusting screw can be turned easily, the conical end and the ball provide a powerful leverage, and while not intended for use as a jack, adjustments can be made under considerable pressure.

ROBINSON H. HARSH
Washington, D. C.

Lathe Chucks for Fragile Pieces

The floating or compensating jaws shown in the chucks illustrated in Figs. 1 and 3 are designed to provide an even gripping pressure on thin shells and tubes without distorting them.

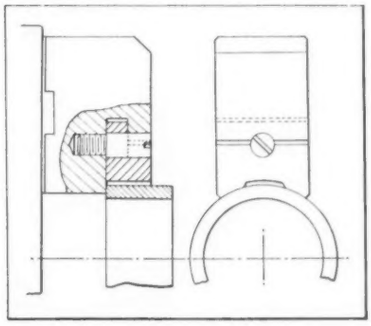


Fig. 1. Floating Chuck Jaw Designed to Exert Even Pressure on Thin Ring

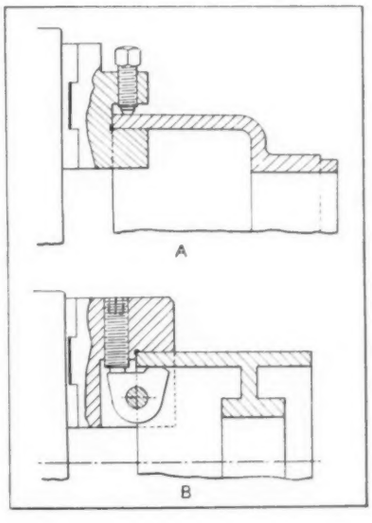


Fig. 2. Methods of Holding Fragile Sections

The chuck jaw shown at *A*, Fig. 2, grips the work only by the set-screw, the jaw adjustment of the chuck being used merely to obtain the required setting for concentricity and diameter of the locating pads. In this case, the work is located from the inner surface. The chuck jaw shown at *B*, Fig. 2, locates the work from the outer surface, and the gripping pressure is exerted by means of the set-screw acting through the tilting clamp.

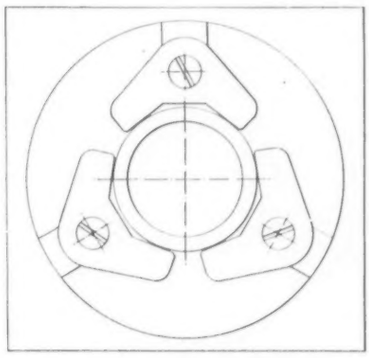


Fig. 3. Chuck with Floating Jaws for Gripping Thin Shells without Distortion

Bath, England FRED HORNER

* * *

Belting Withstands Severe Test

Two horizontal water-wheel belt drives at Prospect Mills, Inc., Lawrence, Mass., have recently been submerged by two floods. In the first, the two belts were under as much as 7 feet of water for five days; in the second, they were submerged under water from 1 to 20 feet deep for twelve days. These belts, of the Condor compensated type, made by the Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J., after each flood were dried, cleaned, dressed, and put back to work, and are now running as well as when first installed.

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

Savings in Lifting Magnet Maintenance

G. O.—A sales representative calling at our office told of a new process for impregnating lifting magnet coils that greatly cuts maintenance costs. Can you give me information about the details of this process?

A.—The following practice of the maintenance department of a large steel mill is probably the procedure to which reference is made. In this steel mill, a method of impregnating the coils has been adopted that has cut the upkeep cost in half. The work is done by a vacuum-pressure system much like that employed in creosoting timber. The reinsulated and green coils are mounted in a case provided with connections for a vacuum pump, a tank containing the preservative, and an air line. The case is then put in an oven and heated for forty-eight hours, after which it is removed, together with the coils, and filled with the hot impregnating compound. When fully charged, compressed air at a pressure of from 80 to 100 pounds per square inch is applied to the surface of the fluid, forcing it deeply into the coils and thus thoroughly impregnating them.

Written versus Verbal Guarantees

Q. V.—A few months ago we gave a salesman a letter stating that he had authority to make a valid contract with a purchaser whom he intended to visit. The salesman made a written contract with the purchaser, who failed to accept delivery. We were forced to sue, and the purchaser now states that the machine did not equal the terms of the *verbal* guarantee made by the salesman, and that he was deceived. We knew nothing about this. What are our rights in this case?

Answered by Leo T. Parker, Attorney-at-Law
Cincinnati, Ohio

One of the oldest rules of law is that verbal agreements, promises, and contracts, made when a written contract is signed, do not affect or change in the least the meaning of a valid written contract. Consequently, when a signed written order is in controversy, testimony that relates to verbal agreements between the buyer and seller will not be considered by the Courts as evidence to vary the meaning of a written contract. On the other hand, a written contract may be modified by *later* written or verbal agreements.

However, it is well settled that a written contract may be rescinded or canceled by either party upon proof that the complaining party was induced to enter into the agreement by *fraudulent* verbal or written statements of the other party. In other words, a valid written contract cannot be varied by verbal agreements, but a contract obtained by a seller through fraud or deceit is not valid, irrespective of whether the fraud consists of written or verbal statements.

Also, while a seller is not liable for fraud when he merely states his own opinion or makes a problematical statement, or purposely utters a false assertion upon which the buyer does *not* rely, it is nevertheless true that a seller is deemed by the law to have practiced fraud and deceit by any act, or failure to perform an act, resulting in the purchaser being deceived *to an appreciable* degree. This point of the law is well illustrated by the fact that various Courts have held that silence on the part of a seller is deceit, when by speaking up he could have prevented the purchaser from being deceived.

Therefore, you are bound by the salesman's verbal guarantee, if the purchaser was deceived by it, or if it did not contradict the written contract, although the purchaser was not deceived. However, if the guarantee was not fraudulent and actually contradicted the written contract, you are not obligated. Moreover, it is seldom that the Courts hold a guarantee of the quality of merchandise to be fraudulent. For this reason, if the quality of the machine was stated in the written contract, any variance therefrom in the salesman's guarantee renders the verbal guarantee void. [See 268 Pac. 738; 258 Pac. 1085; 268 Pac. 343; and 4 S. W. (2d) 515.]

* * *

Device for Calling Executives Around a Manufacturing Plant

A new device for calling executives who may be about the plant when wanted for telephone calls or for other reasons, has been developed by the Sundt Engineering Co., Chicago, Ill. This device, known as the Sunco Soundmaster, dispenses with gongs and bells, and consists simply of an amplifier system, which will say, for example, "Calling Mr. Mason—telephone for you" in tones that carry over the shop noises, yet do not seem excessively loud. The amplifier is contained in a small case, 13 1/2 by 13 1/2 inches by 9 inches deep.

Drilling High-Manganese Steel with Cobalt High-Speed Steel Twist Drills

By PROFESSOR O. W. BOSTON
Director, Department of Metal Processing
University of Michigan, Ann Arbor, Mich.

IN September, 1936, MACHINERY, page 29, a brief article was published, in which the results of drilling tests in high-manganese steel were given. Some time ago experiments were carried out at the University of Michigan for Whitman & Barnes, Inc., of Detroit, in drilling high-manganese steel with drills of various sizes, operating at different feeds, with and without coolants. The results are submitted in the present article.

Table 1. Dimensions of High-Speed Steel Drills Used

Drill		Diameter, Inch	Helix		Point Thinned to 0.098 Inch	Point Angle, Degrees	Lip Error, Inch
Number	Shank No.		of Flute	at Point			
948D	3	0.75	28.5	— 5	By grinding	136	0.001
809D	2	0.75	28.5	+ 5	By polishing	136	0.001
835D	3	0.75	15–18	0	By grinding	136	0.000
895D	2	0.75	15–18	0	By polishing	136	0.000

The cast-steel bars drilled were 2 inches thick, 12 inches long, and 4 inches wide, and contained 13 per cent manganese. The Brinell hardness was approximately 228. In the first series of tests, four 3/4-inch diameter drills having dimensions as given in Table 1 were used. These drills, known as "Hercules Major" high-speed steel drills, were operated at a speed under load of 76 revolutions per minute (15.11 feet per minute), with a feed of 0.005 inch per revolution. Two of the drills had approximately 28 1/2 degree helical flutes, while those of the other two ranged from 15 to 18 degrees. The drill points were thinned so as to give uniform web thicknesses of 0.098 inch. All point angles were 136 degrees instead of the usual 118 degrees. The drills were ground carefully, so as to provide lips of equal length and minimum error in lead.

The figures for torque and thrust, as determined on a dynamometer, and for input power, as determined by a wattmeter, are summarized in Table 2. In drilling hole No. 1, it was noted that the thrust rose rapidly to a maximum of 3600 pounds, but gradually dropped off to 3100 pounds when drilling at a depth of 9/16 inch. The torque rose rapidly to 33 foot-pounds for the first full cutting of the drill, but increased further to a maximum of 40 foot-pounds at the bottom of the hole. After drilling the third hole, the chisel edge of the drill was well rounded off, although the drill operated nearly as satisfactorily as when sharp.

Hole No. 4 was run with the same drill without resharpening. The test was continued until chatter proved serious at a depth of 13/32 inch. The thrust first increased to a maximum of 3700 pounds, after which it fell off slowly to 2900 pounds. At this point, chatter occurred, and the thrust increased rapidly to 5800 pounds, when the test was stopped. The torque started at about 33 foot-pounds, then

Table 2. Torque, Thrust, and Input Power When Drilling Manganese Steel* with 3/4-Inch Special Drills

Hole Number	Depth Drilled, Inches	Drill Number	Condition	Torque, Foot-Pounds		Thrust, Pounds		Gross Power, K.W.	Remarks
				Start	Maximum	Maximum	Average		
1	9/16	948D	Dry	33	40	3600	3100	0.89–0.95	
2	1/2	948D	Dry	32	44	3600	2850	0.85–0.95	
3	9/16	948D	Dry	32	53†	3600	2700	0.89	†Run till chatter occurred
4	13/32	948D	Dry	33	57†	3700	2900	1 to 1.15	†Run till chatter occurred
5	1 1/2	809D	Dry	33.5	45	4900	3000	0.85 to 1.10	
6	0	835D	Sulph. Oil		18‡	9300‡			‡Drill did not bite
7	1 13/16	895D	Dry then Oil§	35, Dry 32, with Oil	34	4300 4600	3400 4200	0.98 0.95–0.98	§Sulphurized lard oil

*The material drilled was 13 per cent manganese steel having a Brinell hardness of 228. The drills were operated at 76 revolutions per minute (15.11 feet per minute), with a feed of 0.005 inch.

Table 3. Torque, Thrust, and Power Required to Drill 13 Per Cent Manganese Steel Dry, with Various Drill Diameters

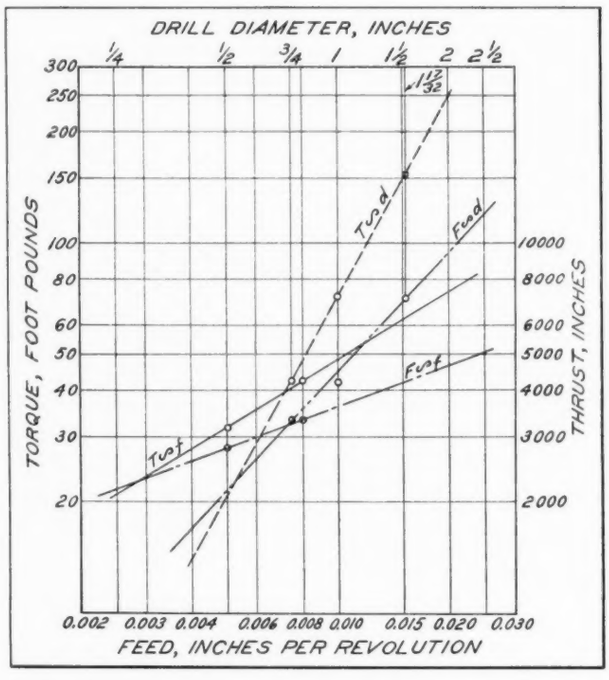
Diameter of Drill, Inches	Speed		Feed, Inch per Rev.	Torque, Foot-Lbs.	Thrust, Pounds		Power, Average			
							Kilowatts		Horsepower	
	R.P.M.	Surface Feet			Maximum	Average	Gross	Net	Gross	Net
3/4	79	15.5	0.008	43	4400	3420	0.938	0.67	1.259	0.898
3/4	79	15.5	0.008	43	4050	3250	0.920	0.65	1.234	0.871
3/4	61	11.96	0.008	45	4800	3700	0.820	0.57	1.100	0.765
1	60	15.7	0.008	71.7	5550	4500	1.08	0.85	1.449	1.140
1	60	15.7	0.008	71.5	4920	4090	1.08	0.87	1.449	1.168
1 17/32	60	24.06	0.008	154	7300	7100	2.288	1.942	3.065	2.607

increased gradually to a maximum of 57 foot-pounds, when chatter occurred and the test was stopped. Holes 1 to 4, inclusive, were run successively for a total depth of 2 inches with the same drill without regrinding. Hole No. 5 was started with a newly sharpened drill. The cut continued until chatter occurred, when both torque and thrust increased perceptibly.

Tests in which Cutting Fluid was Used

Hole No. 6 was started with the third sharp drill having the 15-degree helical flute while a sulphurized oil was being thrown on the work. The drill did not bite, but forced a rather shallow conical hole in the steel casting, the surface of which was highly burnished and work-hardened. The torque developed was negligible, reaching only 18 foot-pounds, whereas the thrust increased directly to a maximum of 9300 pounds, when the test was stopped, as the drill lips were broken.

Hole No. 7 was started again with a sharp drill having a 15-degree helical flute, cutting dry. After the drill started to cut, sulphurized oil was directed on the work. The thrust increased rapidly to 4300 pounds and then fell off gradually to 3400 pounds while cutting dry. When the stream of oil was applied, the thrust immediately increased to 4600 pounds, where it remained practically constant for the balance of the cut. At the start of the cut, when cutting dry, the torque fluctuated, but averaged 35 foot-pounds. As the cutting oil was applied, the torque dropped to 32 foot-pounds and then recovered to a steady average of 34 foot-pounds for the remainder of the cut. The torque and thrust values remained steadier when cutting with the oil than when cutting dry. Also, the chips were broken up better by the application of the oil.



Torque and Thrust in Drilling 13 Per Cent Manganese Steel with Cobalt Steel Drills

Drilling with Variable Feed and Drill Diameter

Further tests in drilling the 13 per cent manganese cast steel were run to determine the torque, thrust, and power developed as a function of drill diameter and feed. New drills 3/4, 1, and 1 17/32 inches in diameter were provided, all having 28 1/2-degree helical flutes but practically 0-degree rake at the cutting edge, as a result of point-thinning. The results are summarized in Table 3. The value of thrust reached a maximum shortly after starting the cut. The average thrust was taken after the thrust had become more uniform at a hole depth of approximately 3/4 inch. The gross and net values of power, expressed in kilowatts and horsepower, as determined for each test by the wattmeter, also are recorded.

Two holes were drilled with the 3/4-inch diameter drill at 79 revolutions per minute, and one at 61 revolutions per minute. The torque in the first two tests averaged 43 foot-pounds. In the third test, at the lower speed, the torque averaged 45 foot-pounds. Maximum and average thrust values at the lower speed are higher than corresponding values for the higher speed.

The torque remained practically uniform over the depth of hole drilled for the feed of 0.008 inch. In the tests with the 0.005-inch feed, as recorded in Table 2, the maximum torque was higher for each successive hole drilled. The accompanying diagram shows the

values of torque and thrust plotted on log-log coordinates under the drill diameter as one variable, and over the feed f as the second variable. The line representing torque T as a function of drill diameter d is straight, making an angle with the horizontal whose tangent is 1.8. This indicates that T increases in direct proportion to $d^{1.8}$. Similarly, the torque-feed curve slopes with the horizontal at an angle whose tangent is 0.60, and indicates that T increases as $f^{0.6}$. An equation, therefore, may be written to represent the relation between torque, feed, and drill diameter when drilling the 13 per cent manganese steel, as follows:

$$T = 1355f^{0.6}\ d^{1.8}$$

The equation for S A E 1045 steel annealed, using standard twist drills, is:

$$T = 1590f^{0.78}\ d^{1.8}$$

The value of the constant immediately preceding f in these formulas, ranges from 1200 to 2300 for the different carbon and common alloy steels and various cutting fluids. For drilling cast iron dry, the formula is:

$$T = 380f^{0.6}\ d^{2}$$

Again referring to the diagram, values of thrust F are plotted as a function of drill diameter and feed as the variables. These two curves give rise to the equation for thrust in drilling the 13 per cent manganese steel, as follows:

$$F = 32{,}000f^{0.4}\ d^{1.1}$$

The thrust equation for the S A E 1045 steel being drilled with standard drills has been found to be:

$$F = 42{,}000f^{0.78}\ d$$

The constant preceding f in the latter two formulas varies from 30,000 to 69,000 for various types of steel.

For cast iron, the thrust formula is:

$$F = 14{,}720f^{0.6}\ d$$

Fortieth Anniversary Celebrated by the Landis Tool Co.

THE fortieth anniversary of the incorporation of the Landis Tool Co., Waynesboro, Pa., was celebrated on May 29, and at the same time tribute was paid to J. Elmer Frantz, president of the board of directors, who joined the organization in 1890 when it was still known as Landis Bros. It was then a partnership that had been formed by F. F. Landis and Abram Landis, who had been employed by the Geiser Mfg. Co. of Waynesboro. These brothers were of an inventive nature, and to meet the need for a grinding machine for manufacturing certain parts, they had designed and built a small universal grinder. This machine operated very successfully, especially after provision had been made for supplying a large volume of coolant during the grinding operation, a practice not generally realized at that time as being necessary for the successful operation of a precision grinding machine.

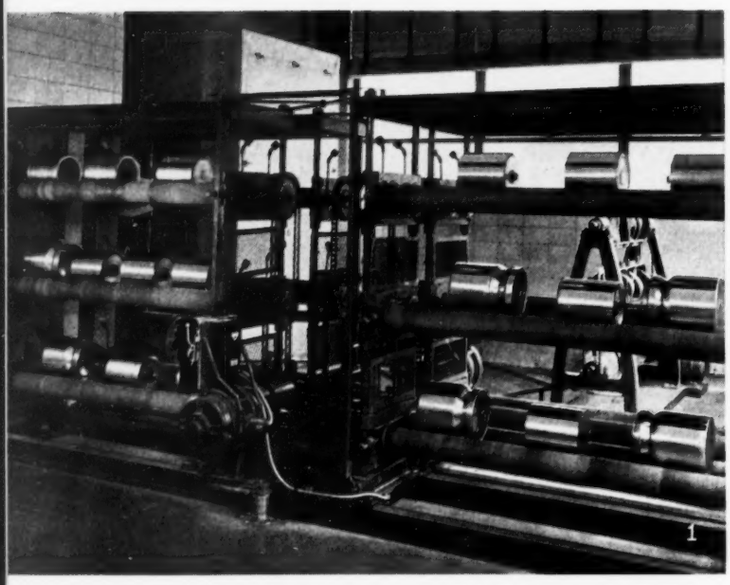
In 1897, the plant that had been established for building this machine was completely destroyed by fire. By that time there had been a growing realization on the part of many Waynesboro citizens that the company was destined to mean much to the community. As a consequence, capital was raised, an incorporation was formed, the plant was rebuilt, and manufacturing operations resumed.

J. Elmer Frantz, President of the Board of Directors of the Landis Tool Co.

The first universal grinder built by Landis Bros. weighed approximately 2300 pounds. For several years, various sizes of this machine were produced, but gradually other types of machines were added to the line and the machines became heavier and more complicated. Almost 150 sizes and types of machines are now built by the concern. The smallest is a 12- by 28-inch universal and tool grinder which weighs 3500 pounds, while the largest is a 60- by 312-inch roll grinder weighing 100 tons.

Six of the sixty-three employes at the time of incorporation in 1897 are still on the payroll of the company, and eighty of the present employes have been connected with the concern for twenty-five years or more. The average wage rate today is about 350 per cent more than when the company was incorporated. At that time there were seventy-seven stockholders, while now there are over 500, an indication of the extent to which the organization might be considered a community enterprise.

Firth-Sterling Steel Co.'s New



A THOROUGHLY modern plant devoted exclusively to the production of sintered carbides was placed in operation last month by the Firth-Sterling Steel Co., McKeesport, Pa. This Firthite-Firthaloy plant was designed to facilitate efficient production without waste of materials or labor. The building is of modernistic design, and is decorated with such materials as glass brick, stainless steel, and aluminum. Some of the rooms have terrazo floors, Carrara glass walls, and linoleum ceilings, so that every surface can be washed and kept clean in order to eliminate the possibility of foreign materials causing defective products.

The first step in the manufacturing process consists of carburizing a mixture of carbon and tungsten powders by heating them to a high temperature in a non-oxidizing atmosphere. The carbides are then crushed by ball-milling, after which they are returned to the mixing room, where they are combined with tantalum carbide, titanium carbide, and cobalt powders. These are mixed in various proportions to produce different grades of carbide.

Distilled water is added to the mixture in a stainless steel filtering sink. Later, most of the water is filtered off, after which the powder is dried in thermostatically controlled ovens, mixed with cobalt powders, and given a final ball-milling by loading in containers which are tumbled continuously for days in special machines.

In this operation, the hard carbide particles are coated with a metal binder, such as cobalt. The milling must continue until every particle has been coated sufficiently to give the desired binder content. From this operation, the charge goes back to the mixing room, where all trace of water is removed. The identity of each ball-milled batch is preserved throughout the manufacturing process, so that the mill number that is finally placed on a finished tool or die permits the material to be traced back through every step to the mixing of the powders.

The powder mixture then goes to a two-story room, in which there is a 400-ton two-way press for compressing large production pieces of carbide, and a small press for compacting individual blanks. At both machines, the proper quantity of powder required for the piece to be pressed is weighed out and then spread uniformly in the mold. All molds produce pieces approximately 20 per cent larger than the finished product to allow for the shrinkage that occurs

Fig. 1. Some of the Units in the Ball-milling Room of the Firthite-Firthaloy Plant

Fig. 2. Baking Ovens where the Carbide Powders are Dried prior to Pressing into Blocks

Fig. 3. Packing Shaped Carbide Pieces into Carbon "Boats" to Insure Uniform Heating

Carbide Sintering Plant

in sintering. The molds are so designed that they can be completely disassembled without affecting the compacted blank, which is very fragile, in spite of the great pressure to which it is subjected. The pressures range from 4000 to 60,000 pounds per square inch.

The next step in the manufacturing process is to give the compacted piece a preliminary heat-treatment. This is done in a pre-sintering furnace having three electrically heated sections in which a hydrogen atmosphere is maintained. The fragile blocks of carbide are placed upon graphite slabs and heated to a temperature at which the metal particles coalesce into a somewhat less fragile piece of chalk-like hardness. After cooling, the piece is ready to be shaped.

In the shaping room, the rectangular and cylindrical blocks of carbide are cut up into the varied shapes and sizes required for tools and dies. Each mechanical device employed for shaping is equipped with exhaust fans for removing all particles of dust produced in these operations. When the piece has been shaped, it is sintered by heating to the melting point of the metal in the compound that melts first, this molten metal then becoming the binder for the other unmelted particles. The sintering furnaces have been designed to insure a hydrogen atmosphere. The heating chamber consists of an alundum tube wound with a resistance wire of molybdenum to permit accurate control of the temperature. A water-cooled section adjoins the heating tube, so that the rate of cooling is also controllable.

For this sintering operation, the shaped pieces are packed in carbon "boats" with carbon powder so as to insure uniform heating. The boats are placed in a preheating section of the tubular furnace and are then pushed mechanically through the heating and cooling sections. After being sintered, the pieces have attained their final hardness and are ready to be used in a tool or die. Each six-pound batch of carbide pieces is carefully controlled for hardness, specific gravity, resistance to cross-breaking stress, and microscopic structure.

One end of the first floor of this building consists of the Firthite tool shop, where finished tools of all kinds are made for users who are not equipped to make their own tools from carbide blanks. The other half of this floor is occupied by the Firthaloy die department, in which there are machines for finishing carbide dies to the many shapes required in drawing metal.

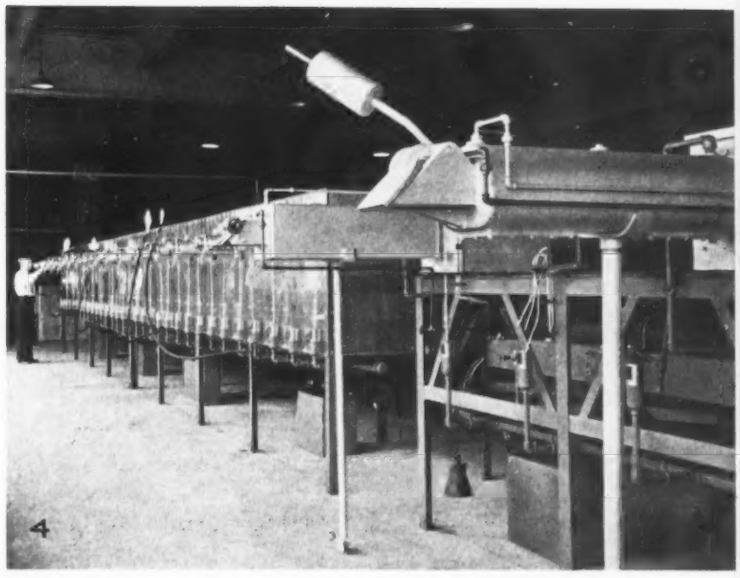


Fig. 4. One of a Battery of High-temperature Hydrogen-atmosphere Sintering Furnaces

Fig. 5. Brazing Department where Firthite Tool Tips are Brazed to Steel Shanks

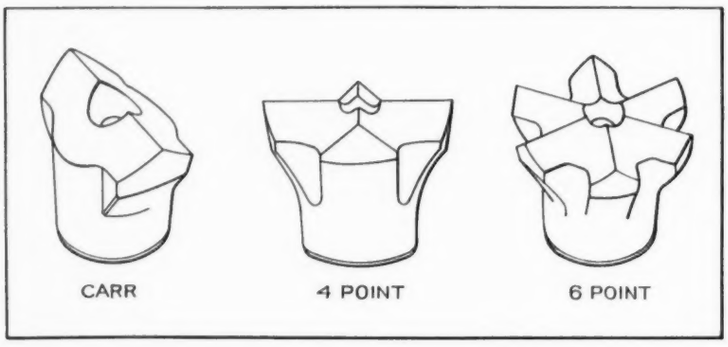
Fig. 6. Drilling Holes Smaller in Diameter than Human Hair with Steel Sewing Needles

The Grinding of Detachable Rock Drill Bits

Detachable rock drill bits are a comparatively recent development. However, they are finding wide application today in many branches of engineering—mining, quarrying, subway and tunnel building, etc. They are an important product of the industry that produces tools for these fields of engineering endeavor.

Until approximately five years ago, the conventional drill bit used in mining and rock-drilling operations consisted of a hollow steel rod with a cutting bit forged on the end. When the cutting bits became dull, they were sent to the blacksmith shop, reforged, and shaped to the desired size.

The present detachable bits were introduced to overcome the objections to this cumbersome and time-consuming method. The cost of these detachable bits ranges from 20 to 40 cents each. They are resharpened by grinding as soon as the edge becomes dulled. Various grinding machines have been designed for this type of grinding.



Three Types of Detachable Rock Drill Bits

Detachable rock drill bits are made in three general types, as shown in the accompanying illustration. These are known as the Carr, or two-point, the four-point, and the six-point types. All types are made in sizes ranging from 1 1/4 to 3 1/4 inches in diameter, by increments of 1/8 inch. The four-point bit is the most popular. Probably 90 per cent of the detachable rock drill bits used today are of this type.

The service rendered by a bit before it is necessary to resharpen it depends upon the accuracy with which it has been ground, the angle of the cutting edge, and the character of rock being drilled. On four-point bits the included angle of the face is generally 120 degrees, and on six-point bits, 60 degrees; but this angle may be increased or decreased in accordance with the degree of hardness of the rock.

According to data obtained from the Carborundum Co., Niagara Falls, N. Y., two operations are required to recondition worn bits. The first of these, known as gaging, consists of grinding the periphery of the bit to the next smallest gage or diameter, removing approximately 1/16 to 1/8 inch of metal. Plain wheels, with what is known as an "A" face, are used for this work. The second or sharpening operation consists of renewing the cutting edge of the bit by what is known as a modified "E" face wheel. This wheel should have a thickness approximately equal to the distance across adjacent points of the largest bit to be ground. The way in which the bit is applied to the wheel has a direct bearing on the wheel selection.

Some operators sharpen a four-point wheel in four cuts, using a heavy pressure and sustained contact. Very hard-grade wheels are required to withstand this action. The use of hard-grade wheels, however, is likely to result in drawing the temper of the bit. It is generally considered better practice, therefore, to take a series of light cuts until the face of the bit is formed properly, in which case much softer wheels can be used, with little likelihood of drawing the temper.

Small bits can easily be sharpened twice, and larger ones quite a number of times; but this depends somewhat on the condition of the bit when it is delivered to the grinder. Bits that are continued in use after losing their first sharpness deteriorate rapidly and make necessary the removal of a larger amount of metal, with proportional shortening of the bit life.

The majority of the machines made for this work carry two wheels, one on each end of the spindle. The wheel on the right-hand side is used for the gaging operation. Its thickness should not exceed 1 1/2 inches nor should it be less than 1 inch. The wheel on the opposite end of the spindle for the sharpening operation in common practice has a thickness of 1 1/4, 1 1/2, or 2 1/4 inches. If the wheel is too wide and precaution is not taken to alternate the bit sizes, two ridges will be worn in the periphery of the wheel, necessitating much dressing.

All machines used for grinding detachable tool bits should have provision for compensating for wheel wear in order to maintain the entire cutting face of the bit in one plane. If this is not done, the cutting face will be concave or convex.

* * *

The annual report of a large machine-building company shows that, for each employe, the company paid approximately $150 in taxes during 1936, or $3 a week for every man and woman employed by the company. In other words, were it not for these taxes placed on industry, every employe could have had an increase of $3 a week in wages, and yet the company could have made the same profits as it did. In addition, the employe pays in taxes, directly or indirectly, about one dollar out of every five that he spends, even though he may not know it.

Points to Consider in Fixture Design

THE following eighteen points that should be considered in designing a fixture or in approving a fixture design were given in a paper read before the American Society of Tool Engineers by Charles J. Martin, of the Gisholt Machine Co. These points are based largely on the author's experience as assistant chief draftsman of one of the largest automobile companies in the world.

1. Location of work.

2. Plenty of clearance to permit loading and unloading work.

3. Clamping methods that will not distort the work and cause it to be inaccurate when removed from the fixture after the machining operation.

4. Clamping arrangement designed so that it will not distort the fixture when clamping the work.

5. Design to facilitate the changing of tools and perishable parts.

6. Provision for getting rid of chips as rapidly as possible in such a way as not to interfere with the cutting tools, and so that the chips will not lie on the fixture, moving parts, or hydraulic pipes. Chips, if not properly taken care of, will cause a great deal of damage to the equipment, that is, to perishable and moving parts of the fixture.

7. Means for making coolant flow freely on the tools and at the same time guiding it so that it will not spray all over the machine and operator.

8. Rigidity of design, to withstand abuse without affecting the accuracy of the fixture. It should be designed to radiate the maximum amount of heat caused by the cutting tools and revolving parts.

9. Perishable parts made of a good grade of alloy steel, heat-treated and ground.

10. Rest plates designed to clean the surface of chips and grit which may adhere to the work as it is moved into position. This is done by machining diagonal grooves across the rest plates, leaving the edges sharp, so that when the work is moved over these plates it will scrape the surface clean.

11. Design of fixture to use standard commercial tools or the standard adopted by the customer, such as drills, reamers, spot-facers, milling cutters, taps, bushings, adjustable drill-holders, or tap-holders. Most designers believe that they must design a special perishable tool and that it is impossible for them to use a commercial tool. In ninety-nine cases out of one hundred, this is only imagination. If manufacturers would check their perishable tool stock, they would find in a great many cases that they have many tools that vary but little in size. If more thought were given to these tools, a large percentage of them could be eliminated.

12. Choice between a manually operated or a hydraulically operated fixture. This depends on the production and size of the part to be machined. In cases where the part is small and the production low, manual operation is preferable. Where the part is large and heavy and the operator would have to handle an excessive amount of weight each day, the fixture should be completely hydraulic. If the operator has to handle a large amount of material, he becomes fatigued and loses his efficiency before the end of the day; hence the gain in efficiency of the hydraulic over the manual fixture would soon pay for the difference in cost.

13. Oil passages completely manifolded in hydraulic fixtures. The manifold should be designed so that hot chips will not collect on it and cause excessive heat in the oil, as this may affect the accuracy of the fixture.

14. Clamping arrangement for a hydraulic fixture designed so that the releasing of the clamps is accomplished with a higher pressure than required for clamping. This is effected by using the piston-rod end of the cylinder for clamping. The hydraulic cylinder, in a great many cases, should operate a mechanical self-locking arrangement, especially where there is heavy-duty machining.

15. Indexing types of fixtures. These are of three types—the trunnion, the rotary table, and conveyor. These fixtures cause more trouble than the single-purpose fixture. The chief sources of trouble are the spacing between stations; the setting of tools so that each station will produce an interchangeable part; and the disposal of chips. The last point is one of the greatest sources of trouble on this type of fixture, and should be given very careful consideration; the coolant should be so directed that it will wash away the chips.

16. Design of fixture so as to be a complete, independent assembly that can be located on the trunnion, rotary table, or conveyor as a separate unit for each station. This will make it possible to remove any one of the fixtures for repairs without affecting the operation of the machine.

17. Indexing mechanism. Whether hydraulic or mechanical, this will always have a tendency to lag or over-run its position. The locating pin should be straight with a bullet nose, so that it will pull the fixture into its correct position and at the same time clean itself of dirt or chips. Never use a taper pin for locating, as it will not clean itself, and any dirt or chips adhering to it will throw the location off.

18. Clamping arrangement for rough casting or forging. For such cases, the design should be such that the clamps can be retightened between each station while the fixture is indexing. When clamping on a finished surface, this is not necessary.

* * *

Do not overlook the fact that available standard equipment may often more economically solve your production problem than the special equipment that at first sight may seem most advantageous.

MATERIALS OF INDUSTRY

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

An Alloy for Extreme Conditions of Corrosion

Another alloy has been added to the series of Hastelloy alloys produced by the Haynes Stellite Co., Kokomo, Ind. The new alloy, known as Hastelloy B, was developed primarily for service in equipment handling hydrochloric acid in all concentrations and at temperatures up to and including the boiling point. It also stands up well in sulphuric and phosphoric acids, acetic and other organic acids, and in non-oxidizing acid chloride solutions. In 20 per cent hydrochloric acid at the boiling point, the rate of penetration of the solution is only 0.0016 inch per month.

Hastelloy B is composed of nickel, molybdenum and iron, being similar to Hastelloy A, except that the proportion of iron has been decreased and the molybdenum content increased. The increase in molybdenum results in a higher ultimate tensile strength and a higher yield point, with practically no loss in ductility or any reduction in area. The tensile strength in the forged, rolled, and fully annealed state is from 135,000 to 140,000 pounds per square inch, and the elongation is 44 per cent in 2 inches. The alloy is unusually strong at high temperatures, as well as at room temperature.

This new alloy is available in the form of castings, wrought parts, rolled plate and sheet, wire, and welded tubing. It is suitable for agitator units, heating and cooling coils, pump parts, condensers, pickling tanks, valves, pipe, and fittings.

Flamenol—A Non-Rubber Insulating Compound

A synthetic insulating compound that is similar to rubber in its characteristics, but does not contain rubber and is not combustible, has been made available commercially by the General Electric Co., Schenectady, N. Y. This compound, known as Flamenol, which is being used as an insulation on cable, is also highly resistant to moisture, acids, alkalies, and oils. It possesses unusual aging characteristics and is strong mechanically.

The properties of Flamenol are such that it can be made a soft and flexible compound with celluloid-like rigidity. It can be put into solution for coating or impregnating, and can be compounded, filled, calendered, and extruded in much the same manner as rubber. This new insulating material is available in a variety of colors for circuit tracing. In most applications it is used without any protective finish, such as braid, lead, or armor.

A New Chromium-Molybdenum Carburizing Steel

The demand for greater manufacturing economies as a result of increased material costs has led to the development of a chromium-molybdenum carburizing steel which has been designated unofficially S A E 4120. Although this steel costs less than other alloy carburizing steels, its properties approach those of the best steels, according to the Climax Molybdenum Co., 500 Fifth Ave., New York City. The steel is said to carburize with minimum predictable distortion, and the distortion is uniform, even in parts of fairly complicated section. In a variety of different-shaped parts, the distortion is so slight that only a small amount of finish-grinding is necessary, even with close tolerances. This 4120 steel takes a hard wear-resistant case, and the depth of case is particularly uniform.

That the physical properties are good is shown by the following examples: A direct-quenched specimen of 0.505 inch diameter had an ultimate tensile strength of 166,000 pounds per square inch, a yield point of 145,000 pounds per square inch, an elongation of 15 per cent in 2 inches, a 50 per cent reduction of area, and a Brinell hardness of 369, while a pot-cooled and reheated specimen of the same diameter had an ultimate tensile strength of 130,000 pounds per square inch, a yield point of 105,000 pounds per square inch, an elongation of 23 per cent, a 57 per cent reduction of area, and a Brinell hardness of 285.

A direct-quenched 2-inch diameter specimen had an ultimate tensile strength of 113,000 pounds per square inch, a yield point of 85,000 pounds per

square inch, an elongation of 26 per cent, a 58 per cent reduction of area, and a Brinell hardness of 269, whereas a 2-inch diameter pot-cooled and reheated specimen had an ultimate tensile strength of 108,000 pounds per square inch, a yield point of 81,000 pounds per square inch, an elongation of 24 per cent, a 55 per cent reduction of area, and a Brinell hardness of 228.

Tests have shown that this steel machines well on a production basis. It is easily annealed, forges readily, and ordinary shop carburizing practice produces good case and core properties. A partial list of parts already being made from this steel includes medium and heavy-duty gears and pinions, wrist-pins, worms, sucker-rod couplings, shafts, and anti-friction bearings.

Chloroprene Rubber Used to Counteract Metal Expansion and Contraction

Diesel engine radiators manufactured by the Young Radiator Co., Racine, Wis., are made with the usual cooling fins, and have, in addition, eight seamless brass by-pass tubes that increase the cooling capacity. These tubes expand and contract with the varying temperatures of the radiator, a condition that formerly resulted in their being pulled away from the header plates to which they were attached, thus causing leakage of water.

This trouble has been overcome by making each tube in three sections and connecting these sections with two short lengths of Neoprene rubber hose, which is a product of E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. This material not only has the necessary resilience to take up the variations in the tube lengths under the temperature extremes, but also withstands the effects of anti-freeze solutions.

Phenolic Molding Compounds with Special Characteristics

Several phenolic molding compounds with properties that adapt them for specific applications have been placed on the market within recent months by General Plastics Inc., North Tonawanda, N. Y. One of these materials, known as Durez 1590, is claimed to have an impact strength five times greater than that of standard molding materials. This compound is intended for industrial applications where high resistance to shock is desired in combination with other properties of molded plastics. This material molds and preforms easily, has a relatively low bulk factor, and in molded form has a somewhat rippled surface.

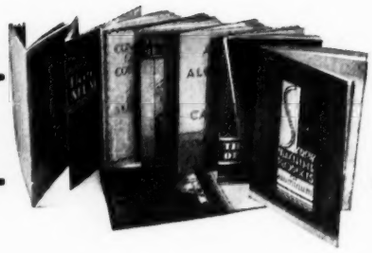
Another compound, known as Durez 1601, has an unusually low power factor and is intended primarily for use on high-frequency radio and other electrical equipment. The power factor is 0.34 per cent (ASTM). The material also has good molding qualities, which permit it to be used for a variety of parts on X-ray machines, diathermy apparatus, high-frequency measuring and research equipment, and short-wave radio sets.

A new line of thermo-setting phenolic resins has been brought out by the concern in both liquid and powder form. Certain types of these resins, when used with rubber and drying oils, or by themselves, for impregnating or bonding loose or woven asbestos, give the finished product a higher heat resistance, greater strength and a uniformly stable coefficient of friction. Other resins in this series improve the properties of fixed resistance units, the bonding of ground cork in gasket stock, etc. Still other forms are used for the production of laminated tubes by the dry resin process.

Molded Plastic Two Feet in Diameter Weighing Only Five Pounds

The accompanying illustration shows a light-reflector of Plaskon having an area of 550 square inches, but weighing only 5 pounds. This is the largest one-piece plastic molding ever made by the General Electric Co. The diameter measures 26 1/2 inches, and the depth 11 1/4 inches. A 5-ton steel mold is used for molding this reflector. Four months were required for making the mold, a week of which was needed for the heat-treatment, for which a quenching bath of approximately 15,000 gallons of circulated oil was used. The press in which this reflector is molded is a 1500-ton hydraulic press, said to be the largest in the plastic industry. The reflector was molded at the Meriden, Conn., works of the General Electric Co., where three of these large molding presses are installed.

Huge Plaskon Light-reflector, the Largest One-piece Plastic Molding ever Made by the General Electric Co.

NEW TRADE  LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts, and Materials. Copies can be Obtained by Writing Directly to the Manufacturer

Reduced Price Carboloy Standard Blanks

CARBOLOY COMPANY, INC., 2987 E. Jefferson Ave., Detroit, Mich. Catalogue M-37, announcing three new styles of standard Carboloy blanks available at reduced prices. The three styles in ninety-six sizes have been designed for wide application. They are adaptable for use on more than 90 per cent of all carbide tools in use today. They can also be used by manufacturers in making their own tools. In many cases, simple revisions in tool design will enable users to utilize these standard blanks at a substantial saving in carbide cost. It is emphasized that these are not general price reductions, but special reductions made possible by quantity production. A full explanation, together with the new, low standard blank prices, a description of the standard tools and full-scale drawings of the different sizes and styles is given.

Roller Bearings

TIMKEN ROLLER BEARING CO., Railroad Division, Canton, Ohio. Folder entitled "The Timken Line," illustrating the many applications of Timken roller bearings in railroad equipment, including steam, electric, and Diesel locomotives, high-speed streamline trains, and other rolling stock. Several graphs are presented to show how these bearings reduce starting and operation friction and hold operating temperatures within safe limits.

Ball Bearings

NEW DEPARTURE DIVISION OF GENERAL MOTORS CORPORATION, Bristol, Conn., is offering a set of nineteen sheets (Bearing Lay-out Folder LF) for the use of engineers, designers, draftsmen, and others, containing full-size drawings of ball bearings for lay-out work. Single-row, double-row, Radax, duplex, and self-sealed bearings are included in a complete range of sizes for all series.

Instrument Slide-Rule

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa., is distributing an ingenious slide-rule indicator for use in selecting the proper instruments for any application, whether central stations, industrial plants, or transportation industry. This slide-rule, known as the "Instrulector," shows at a glance what instruments to use, their range, approximate price, size, and descriptive literature available.

Indicating and Controlling Equipment

BROWN INSTRUMENT CO., Wayne and Roberts Aves., Philadelphia, Pa. Folder 92-2, entitled "Standardizes Quality in the Heat-Treatment of Metals," describing the advantages of using the Brown Analy-Graph in heat-treating processes for the exact measurement of furnace atmospheres. A description of the Brown Protectoglo (combustion safeguard) system is also included.

Motor Control Equipment

ALLEN-BRADLEY CO., 1331 S. First St., Milwaukee, Wis. Booklet entitled "The Story of the Solenoid Starter," describing the fundamental differences between the solenoid type motor starter and the conventional clapper type starter. Many typical applications of solenoid motor control are illustrated, and a brief resume of the Allen-Bradley line is given.

Precision Gages

SHEFFIELD GAGE CORPORATION, Dayton, Ohio. Catalogue on precision gages, including visual gages, thread plug and ring gages, thread ring-gage holders, measuring wires, cylindrical plug and ring gages, tapered gages, adjustable limit gages, and special gages. The bulletin also describes the Sheffield strainometer, screw-thread lead testing machines, and vibration frequency meters.

Power Transmission and Conveyor Chain

BALDWIN-DUCKWORTH CHAIN CORPORATION, Springfield, Mass. Bulletin 59, containing data on Baldwin-Duckworth non-corrosive and heat-resistant chains for power transmission and conveyor purposes. Bulletin 60, listing dimensions and prices of standard hub sprockets for single, double, and triple roller chain.

Multiple-Disk Clutches

ROCKFORD DRILLING MACHINE DIVISION OF BORG-WARNER CORPORATION, 310 Catherine St., Rockford, Ill. Booklet illustrating and describing the construction of Pullmore multiple-disk clutches, which are made in single and double types. Typical applications of these clutches on a variety of machines are shown.

Monel Metal Parts

INTERNATIONAL NICKEL CO., INC., 67 Wall St., New York City. Circular containing data on Monel gaskets and how to select the type best suited to the requirements. Bulletin entitled "Making Old Pumps Good as New with Monel Parts." Leaflet discussing the application of Monel in the construction of valve parts.

Lathe and Drill Chucks

WESTCOTT CHUCK CO., 200 E. Walnut St., Oneida, N. Y. Catalogue 537, describing the Westcott line of lathe and drill chucks which includes a complete range of sizes and types for direct mounting on standard flanged spindle noses and on standard taper-key drive spindle noses. Price lists are included.

Plastic Moldings

CHICAGO MOLDED PRODUCTS CORPORATION, 2145 Walnut St., Chicago, Ill. Booklet entitled "The Story of Plastic Molding," containing a brief

description of conventional mold making, molding methods, and plastic molding materials and their properties. A list of parts available from stock molds is included.

Bolts and Nuts

RUSSELL, BURDSALL & WARD BOLT AND NUT CO., Port Chester, N. Y. Booklet entitled "Handbook of Common Machine Fasteners," especially intended for the drafting-room, showing twenty-six illustrations of the latest accepted standard method of drawing various types of bolts, nuts, and rivets.

Flexible Couplings

FALK CORPORATION, Milwaukee, Wis. Bulletin 4100, descriptive of an improved design of flexible coupling known by the trade name of "Steelflex." Information is given on the design, rating, method of selection and dimensions of these couplings, and installation photographs are shown.

Precision Adjustment Shims

LAMINATED SHIM CO., INC., 21-24 Forty-fourth Ave., Long Island City, N. Y. Catalogue descriptive of "Laminum" precision adjustment shims, by means of which precision adjustments of 0.002 or 0.003 inch can be made by simply peeling off the laminations of a solid unit of brass.

Hydraulic Grinders

LANDIS TOOL CO., Waynesboro, Pa. Catalogue D-37, illustrating and describing Landis 6- and 10-inch Type C plain hydraulic grinders and their application on various classes of work. The catalogue is profusely illustrated with general and detailed views of the machines.

Miller-Shapers

COCHRANE-BLY CO., Rochester, N. Y. Circular illustrating various applications of the Cochrane-Bly No. 14 single and duplex universal vertical miller-shaper which is adapted for drilling, boring, milling, and shaping operations. Complete specifications are included.

Electric Maintenance Equipment

IDEAL COMMUTATOR DRESSER CO., 1011 Park Ave., Sycamore, Ill. Catalogue covering the Ideal line of motor and other electric maintenance equipment, including commutator and ring resurfacers and grinders, truing tools, mica undercutters, etc.

Cold-Drawn Steel

UNION DRAWN STEEL CO., Massillon, Ohio. Circular entitled "Tackling Your Steel Fabricating Problems with Rolled-Up Sleeves," outlining the service offered by the company in aiding manufacturers to obtain the bar steel best adapted for their work.

Arc-Welding Equipment

LINCOLN ELECTRIC CO., Cleveland, Ohio, is distributing a pictorial sheet entitled "Pictorial of Welding Progress," showing many interesting applications of arc welding and briefly describing the savings effected with this process, both in fabrication and in repair work.

Flexible Metal Hose

CHICAGO METAL HOSE CORPORATION, Maywood, Ill. Catalogue containing many illustrations showing applications of flexible metal hose. The book also illustrates the latest developments in flexible metal hose design and construction.

Pumps

FAIRBANKS, MORSE & CO., 900 S. Wabash Ave., Chicago, Ill. Bulletins 5814-F and 5870, illustrating and describing Fairbanks-Morse ball-bearing centrifugal pumps. Bulletin 6150, descriptive of simplex self-oiling power pumps.

Transmission Belting

ALEXANDER BROS., INC., Philadelphia, Pa. Catalogue A-117, containing information on Tentacular transmission belting, covering the construction and design, including technical data on belt speeds, horsepower ratings, etc.

Flexible Couplings

THOMAS FLEXIBLE COUPLING CO., Warren, Pa. Catalogue containing information on the various types of flexible couplings made by this concern, including complete specifications. Many different installations are illustrated.

Blueprinting Machines

PARAGON-REVOLUTE CORPORATION, Rochester, N. Y. Catalogue illustrating and describing the Revolute 3H automatic blueprinting machine which exposes, develops, and drys in one continuous operation.

Vibration Testing Equipment

SUNDT ENGINEERING CO., 4238 Lincoln Ave., Philadelphia, Pa. Bulletin 5137, describing the many industrial applications of the Neobeam Oscilloscope, a vibration and noise testing machine.

Heat-Treating Equipment

LEEDS & NORTHRUP CO., 4921 Stenton Ave., Philadelphia, Pa. Folder describing the application of Rayotube-Micromax equipment for measuring slab-furnace temperatures.

Die-Casting Machines

MADISON-KIPP CORPORATION, 203 Waubesa St., Madison, Wis. Catalogue descriptive of Madison-Kipp die-casting machines, die-castings and dies; air tools; and fresh oil lubricators.

Skid Platforms

LEWIS-SHEPARD CO., 175 Walnut St., Watertown, Mass. Folder 146, illustrating various types of skid platforms for conveying materials, parts, and products around a plant by the lift-truck method.

Inclinable Presses

J. L. LUCAS & SON, INC., 3 Fox St., Bridgeport, Conn. Circular containing complete specifications covering the various types of Loshbough-Jordan inclinable presses handled by this concern.

Pulleys and Flexible Couplings

CONGRESS TOOL & DIE CO., INC., 9030 Lumpkin Ave., Detroit, Mich. Circular containing data on this company's line of pulleys and flexible couplings, including dimensions and price lists.

Industrial Furnaces

W. S. ROCKWELL CO., 50 Church St., New York City. Catalogue 369, containing typical illustrations of a few of the thousands of Rockwell electric, gas, and oil industrial furnaces.

Diamond Wheel-Dressing Tools

KOEBEL DIAMOND TOOL CO., 1214 Oakman Blvd., Detroit, Mich. Leaflet entitled "Eggs *Some* Fresh," illustrating multi-set, multi-point, and multi-edge diamond dressers.

Material-Handling Equipment

CLEVELAND CRANE & ENGINEERING CO., Wickliffe, Ohio. Circular illustrating various applications of Cleveland hand-propelled carriers with motor-operated hoists.

Heat-Treating Equipment

SURFACE COMBUSTION CORPORATION, Toledo, Ohio. Bulletin SC-80, descriptive of horizontal gas-fired radiant tube heating elements as applied to every phase of heat-treating.

Welding Electrodes

ELECTROLOY CO., INC., 50 Church St., New York City. Circular announcing two new improvements in standard tapered spot-welding electrodes—cold formed and plated.

Corrosion-Resisting Equipment

DURIRON CO., INC., Dayton, Ohio. General catalogue covering corrosion-resisting alloys and equipment made exclusively for handling corrosive solutions.

Synthetic Plastics

GENERAL PLASTICS, INC., 15 Walck Road, North Tonawanda, N. Y. Reprint of an article appearing in *Fortune*, entitled "General Plastics' Durez."

Power Transmission Equipment

T. B. WOOD'S SONS CO., Chambersburg, Pa. Bulletin 270, briefly describing the features of the U. G. automatic belt contactor.

Novel Use of a Kipp Air Chipper in Boat Building. Copper Rivets being Headed on a Lapstrake Sailing Dinghy at the Plant of the Herreshoff Mfg. Co., Bristol, R. I., the Chipper being Fitted with a Special Tool. The Former Method of Using a Small Peening Hammer was Laborious and the Results Non-Uniform

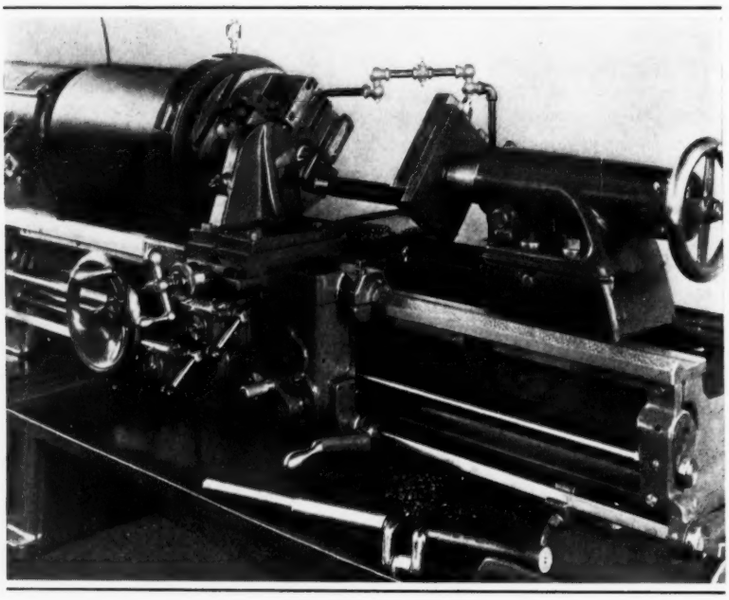
Space for Dealers' Names on Trade Literature

The following communication, which has been received from a machinery dealer in California, may be of interest to machinery manufacturers: "Will you try to find a few lines in MACHINERY for this 'wail.'? Why, Oh why, don't machinery manufacturers allow suitable space on their sales literature for the dealer's imprint? A small detail, but of concern to the dealer, and no reason to be overlooked by the manufacturer if he will stop and think a moment."

* * *

Conferences on Strength of Materials

The Massachusetts Institute of Technology, Cambridge, Mass., is conducting a special summer program and conferences on the strength of materials for four weeks, from June 21 to July 16. The last two days of the program (July 15 and 16) will be devoted to all-day conferences on the fatigue and creep of metals. Dr. H. J. Gough of the National Physical Laboratory, Teddington, England, R. L. Templin of the Aluminum Co. of America, and R. E. Peterson of the Westinghouse Electric & Mfg. Co., among others, will lecture on the fatigue of metals. H. J. French of the International Nickel Co., Dr. A. Nadai and C. R. Soderberg of the Westinghouse Electric & Mfg. Co., E. L. Robinson of the General Electric Co., T. McLean Jasper of the A. O. Smith Corporation, and A. B. Kinzel of the Union Carbide & Carbon Research Laboratories will be among the lecturers on the creep of metals. Further information can be obtained from John M. Lessells, Department of Mechanical Engineering, Massachusetts Institute of Technology.



Turning a Single-throw Crankshaft of the Type Used Extensively in the Construction of Textile Machinery, in a Specially Equipped Reed-Prentice Lathe. Both the Chuck and Tailstock Have a Micrometer Adjustment for Regulating the Amount of Throw from 1 15/16 to 4 11/16 Inches. Crankpins from 1 9/16 to 3 1/2 Inches Diameter can be Turned with this Equipment

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

"Hy-Draulic" Double-Housing Planer, Open-Side Shaper, and High-Speed Shaper

A planer of double-housing construction has been added to the line of "Hy-Draulic" planers and shapers, built by the Rockford Machine Tool Co., Rockford, Ill. This heavy-duty machine is illustrated in Fig. 1. A distinctive feature is that the use of a hydraulic unit enables a standard constant-speed electric motor to be used for driving purposes instead of the conventional reversing motor.

There are a number of other advantages mentioned by the machine builder for the hydraulic drive. For instance, the cutting speed of the table attains the selected rate almost instantly, and it remains constant throughout the cutting stroke. Reversals of the table are effected quickly and smoothly, and short strokes can be made at approximately shaper speeds. The cutting speeds are independent of the return speeds, and there is an infinite adjustment of both speeds between the high and low limits. Greatly increased life of the cutting tools between grinding is also said to result from hydraulic operation. The table can be stopped, "inched," or reversed at any point in its travel.

The cross-feed to the heads is also hydraulic, and can be adjusted to any amount between the maximum and minimum limits. Feeding takes place while the tool is clear of the work, before entering the cut. A safety valve provides protection to the hydraulic drive.

The pendent switch has push-button stations for controlling the direction of the rapid traverse of the rail-heads, the elevation or lowering of the rail, and the operation of the master motor switch, and for stopping the entire machine instantly. A hydraulic rail clamp operates automatically in conjunction with the power elevation of the rail. Power rapid traverse to all heads is provided by a direct-connected motor.

The cutting speeds and the rapid return of the table are controlled through handwheels on each side of the hydraulic power unit, while the hydraulic feeds can be adjusted instantly by means of a ball-crank that is reached from the normal working position of the operator. Hydraulic tool-lifters are another unusual feature of this machine.

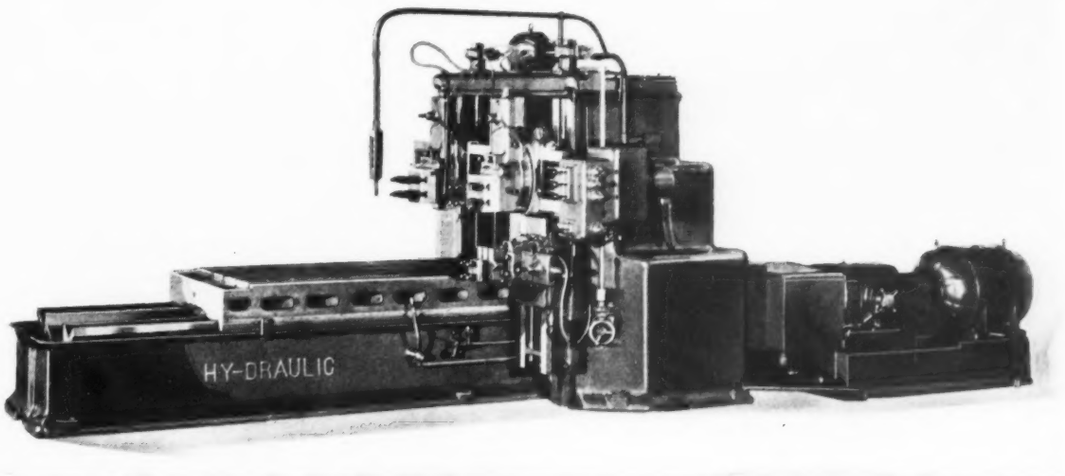


Fig. 1. "Hy-Draulic" Double-housing Planer Intended for Heavy-duty Applications, which is Equipped with a Constant-speed Driving Motor and Hydraulic Unit

The cross-rail is a single casting in the form of an inverted U and is made with long vertical bearings which slide on straight ways on the columns. A solid support is thus provided for the side-head sub-rails. One-shot pressure lubrication is provided for the rail-heads, side-heads, and feed units. This double-housing planer can be built in different table lengths from 9 to 19 feet, and in different stroke lengths from 8 to 18 feet. Other important specifications are as follows: Maximum distance from table to rail, 48 1/2 inches; maximum travel of right- and left-hand rail-heads, 55 inches; maximum vertical travel of rail-head tool, 12 inches; and width of table, 44 inches.

A 36-inch open-side shaper of hydraulic type recently brought out by the same concern is illustrated in Fig. 2. This machine is based on the same principle as previous models, in that the work is reciprocated instead of the tool. A double-length bed and planer type table support the work solidly at all points in its travel. The tool-head is carried on an adjustable rail which has a brace extending to the rear of the column.

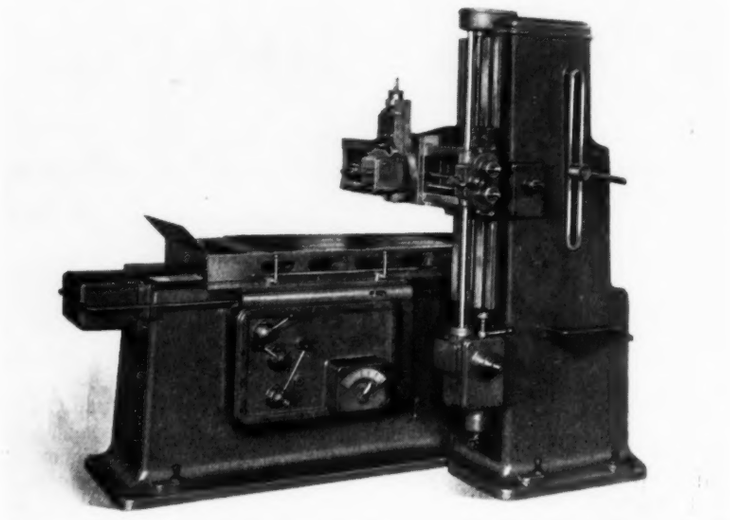


Fig. 2. "Hy-Draulic" Open-side Shaper of 36-inch Nominal Capacity which has been Brought out by the Rockford Machine Tool Co.

Advantages claimed for this machine construction include the speed and convenience of a shaper, in combination with the accuracy and easy set-up of a planer. A side-head can be supplied as extra equipment to increase the productive capacity of the machine.

With the hydraulic drive provided on this shaper, cutting speeds and pressures are constant throughout the cutting stroke. Any stroke length and position relative to the tool can be obtained instantly without stopping the table and without affecting the cutting speed, which can be adjusted to any desired rate within the capacity of the hydraulic equipment. The cross-feed of the tool is also actuated hydraulically and takes place just before the tool enters the work.

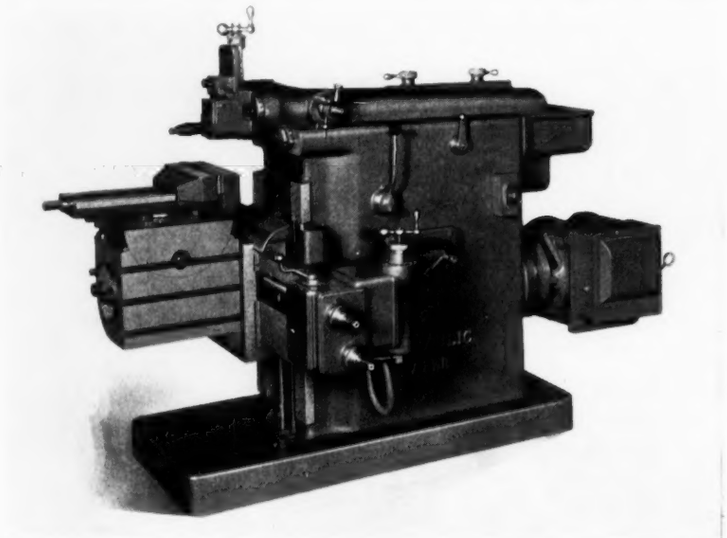


Fig. 3. Twelve-inch "Hy-Draulic" Shaper which can be Operated at Speeds up to 400 Strokes a Minute

Stroke lengths can be changed readily to suit the contour of irregular work, thus eliminating "air cutting." The tool can be stopped anywhere in a cut and "inched" or reversed. The operation of one lever stops the machine and locks the hydraulic circuit. This machine has a maximum stroke of 38 1/2 inches, and a minimum stroke of 1 inch. The vertical travel of the tool is 9 inches, and the horizontal travel 30 inches. The maximum distance from the table to the cross-rail is 24 inches.

The advantages of "Hy-Draulic" shapers that have hitherto been available in 16-inch and larger machines are now also provided in the 12-inch high-speed shaper, shown in Fig. 3. This machine is capable of making 400 and even more short strokes a minute. Speeds

on long strokes are proportionately high. The minimum length of stroke is 1/2 inch, and the maximum length 13 inches.

A single control lever starts and stops the ram and also selects high or low ranges of cutting speeds. Duplicate levers on opposite sides of the column increase the operating convenience. The length and position of the stroke are adjusted without stopping the ram, by means of handles on top of the ram, while the direction of the stroke can be reversed instantly through a lever on the side of the column.

The motor is mounted off the floor, as shown, and is direct-connected to the hydraulic unit. Any desired cutting speed within the high or low range can be obtained instantly through a lever mounted on the side of the column. A direct-reading scale shows the cutting speed being used. Another lever adjacent to the cutting speed lever controls the hydraulic table feeds, and a lever at the right-hand end of the rail controls the direction of the table feeds.

Fafnir Pillow Blocks with Rubber-Mounted Ball Bearings

Pillow blocks in which a ball bearing is mounted in resilient live rubber were placed on the market several months ago by the Fafnir Bearing Co., New Britain, Conn., primarily for use in air-conditioning and ventilating equipment. The rubber mounting of these pillow blocks eliminates noise, compensates for shaft misalignment, and permits a slight longitudinal shaft expansion.

The company has recently announced an improvement in these pillow blocks, the ball bearing now being of the wide inner-ring type having a self-locking collar. This makes for easy installation, as the shaft is simply slipped through the bearing unit, the self-locking collar is engaged and turned, and the set-screw tightened. The bearing is then secured to the shaft. Removal of the shaft is equally easy.

The ball bearings supplied for these pillow blocks are manufactured to inch, rather than metric dimensions, and therefore fit standard shafts without machining. The pillow blocks are offered in bore sizes ranging from 1/2 inch to 1 7/16 inches.

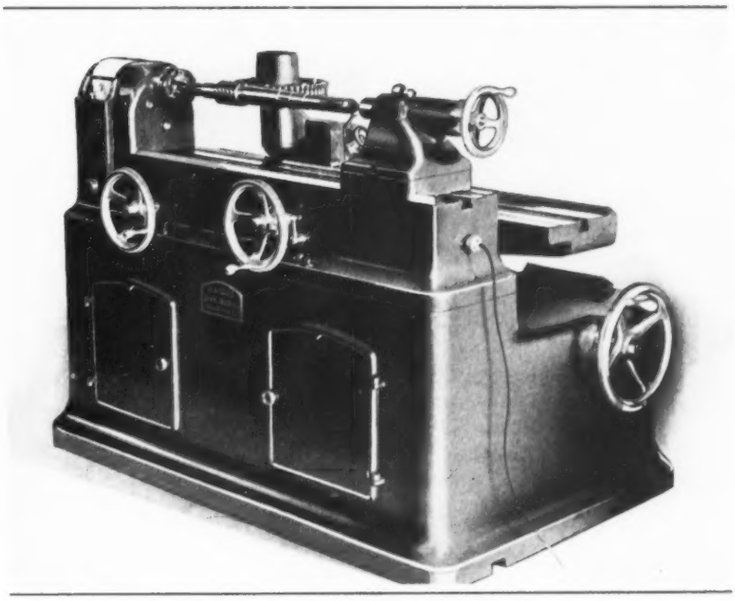
Worm and Worm-Wheel Checking Machine

The Illinois Tool Works, 2501 N. Keeler Ave., Chicago, Ill., have supplemented their line of gear-checking equipment with the worm and worm-wheel checking machine here shown. This equipment is designed to check center distance, side height, helix angle, eccentricity, and the jump per tooth as the worm threads mate with the teeth of the wheel. Also, the machine produces a chart of the running worm and worm-wheel, from which a determination can be made as to whether the tooth profile, spacing, interference, or eccentricity is in error.

The charting mechanism operates at a ratio of 200 to 1, so that an error of 0.001 inch between a worm and worm-wheel shows as though it were 0.200 inch on the chart. The worm-wheel can be tilted at any angle to obtain full bearing on the teeth, after which a reading can be made to determine the position of the worm-wheel spindle relative to the right-angle position. If the hobbing machine is then set to this reading, worm-wheels will be hobbed with correct helicoidal paths.

The main bearings and cross-slides of the machine are provided with ball bearings to insure sensitive operation. A pair of stocks, not shown, is mounted on the rear bed to carry spur or helical gears in a running test. Various parts of the machine are chromium-plated or made of aluminum to avoid tarnishing.

Worm and worm-wheel combinations with a minimum center distance of 5 inches or a maximum center distance of 24 inches can be accommodated on this equipment. The front stocks swing 15 inches in diameter and take lengths up to 36 inches between centers, while the rear stocks swing 24 inches in diameter and take lengths up to 48 inches. Worms up to 1000 pounds in weight and worm-wheels up to 3000 pounds can be handled.



Worm and Worm-wheel Checking Machine Built by the Illinois Tool Works

Red Ring Gear-Lapping Machine

The latest development of the National Broach & Machine Co., Shoemaker and St. Jean Sts., Detroit, Mich., is a Red Ring lapping machine for correcting errors in the spiral angle, concentricity, involute curvature, and tooth spacing of gears. This new GLF model is easier to set up than preceding models, and is more rigid. It is based on the crossed-axes principle of lapping, a lap gear driving the work gear. The lap gear is revolved in one direction for lapping one side of the work-gear teeth, and is then rotated in the opposite direction for lapping the other side.

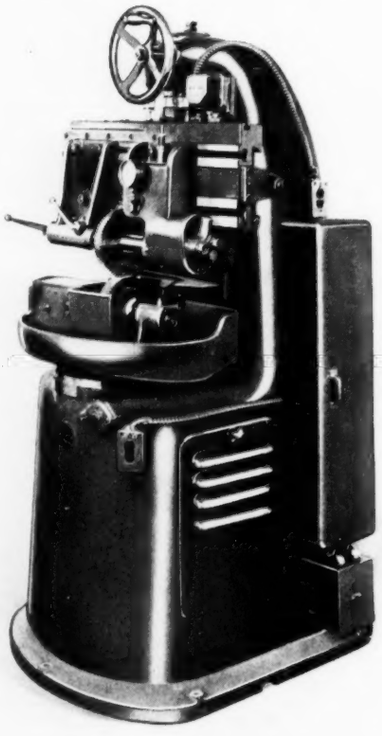
The angle between the work-gear spindle and the lap spindle is readily adjustable, the lap being mounted on a table which has a swing of 15 degrees. A vernier adjustment facilitates close settings. The work-gear spindle is carried on a cross-slide which automatically reciprocates the work gear across the face of the lap. This cross-slide movement is actuated and controlled hydraulically.

Practically any lapping cycle is easily available, and the length, speed, and number of strokes can be varied at will. Any given number of strokes can be made before the direction of lap rotation is changed, and likewise, any number after the rotation is changed. This cycle flexibility permits, when desired, a greater degree of lapping on one side of a gear tooth than on the opposite side. Thus gear teeth can be lapped to closer tolerances and with smoother surfaces on the driving side than on the opposite side. The entire cycle is automatic, so that successive gears are lapped uniformly.

A hydraulic brake is employed to load the work-gear spindle, so as to provide the necessary pressure between the teeth of the lap and the work gear. This pressure is indicated by a dial on the front of the cross-slide and can be accurately regulated to suit individual gears. The machine will accommodate gears up to 8 inches in diameter, and laps with face widths up to 3 3/4 inches can be employed.

Improved Railroad Shop Machine Tools

The Consolidated Machine Tool Corporation, Rochester, N. Y., has made important improvements in a number of heavy machine tools built primarily for use in railroad shops. A Betts hydraulically fed car-wheel boring machine which has been redesigned to provide both operating and production advantages



Red Ring Gear-lapping Machine for Correcting Errors in Spiral Angle, Concentricity, Involute Curvature, and Tooth Spacing

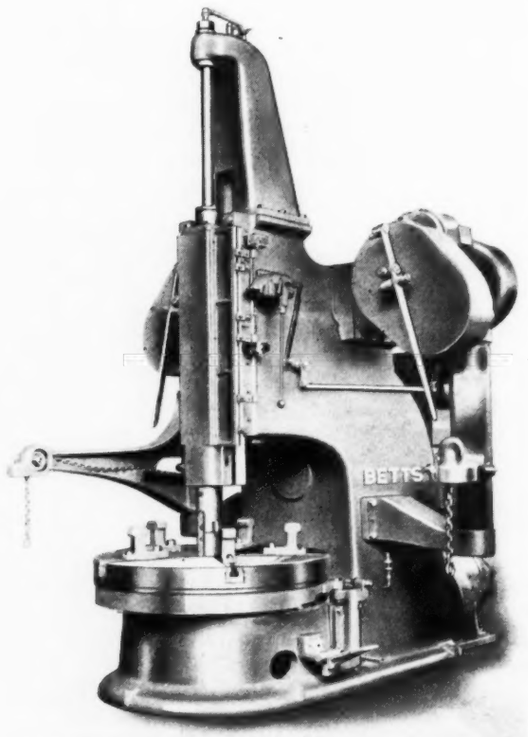


Fig. 1. Betts Hydraulic-feed Car-wheel Boring Machine Redesigned to Provide Operating and Production Advantages

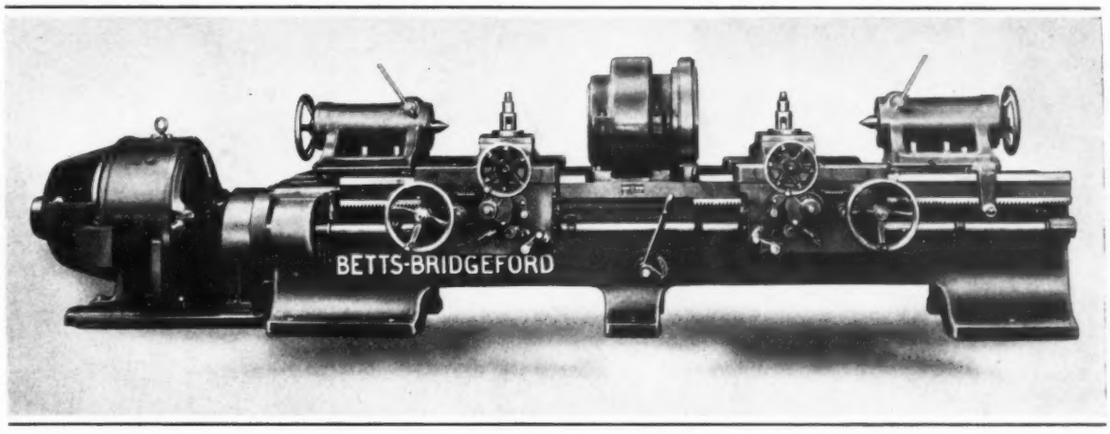


Fig. 2. Betts-Bridgeford Car Axle Lathe with Hardened and Ground Steel Plate Bed Ways and Renewable Carriage-bearing Surfaces

is illustrated in Fig. 1. After a car wheel has been loaded on the table and the machine has been started by the operator, the chuck jaws tighten automatically, thus permitting the operator immediately to remove bored wheels to the wheel press and get the next wheel that is to be bored.

In the operating cycle, the boring-bar travels downward at a rapid rate to the beginning of the roughing cut, changes to a roughing feed, changes to a finishing feed, dwells for the chamfering cut, and rapidly returns to the starting position, where it stops. Cast-iron and steel car wheels up to 42 inches in diameter can regularly be handled, and by special arrangement, wheels up to 48 inches.

A Betts-Bridgeford center-drive lathe designed for the complete rough- and finish-turning of car axles and burnishing of the journals is shown in Fig. 2. The bed ways of this lathe are hardened and ground steel plates which are anchored to the bed by a tongue and groove. The carriage-bearing surfaces, instead of being gray iron, as is usual practice, are faced with heavy bronze linings that can be conveniently renewed. These improvements facilitate the maintenance of accuracy as the machine grows old in service.

Four "Timkenized" tailstocks are another feature of this machine. Collars on the feed-shaft automatically knock out the carriages at any predetermined points.

An end-driven axle lathe of the same general design, except for the driving means, has also been developed by the concern. This lathe, like the one just described, is provided with hardened and ground steel plates for bed ways and with renewable bronze carriage-bearing surfaces.

These center-drive and end-drive axle lathes have been supplemented by the Betts-Bridgeford axle burnishing lathe, illustrated in Fig. 3, which is designed for handling all sizes of M.C.B. axles on a production basis. This machine consists essentially of a heavy bed; two carriages, on which opposed burnishing rollers are mounted; two tailstocks; and a set of ring-gear chucks.

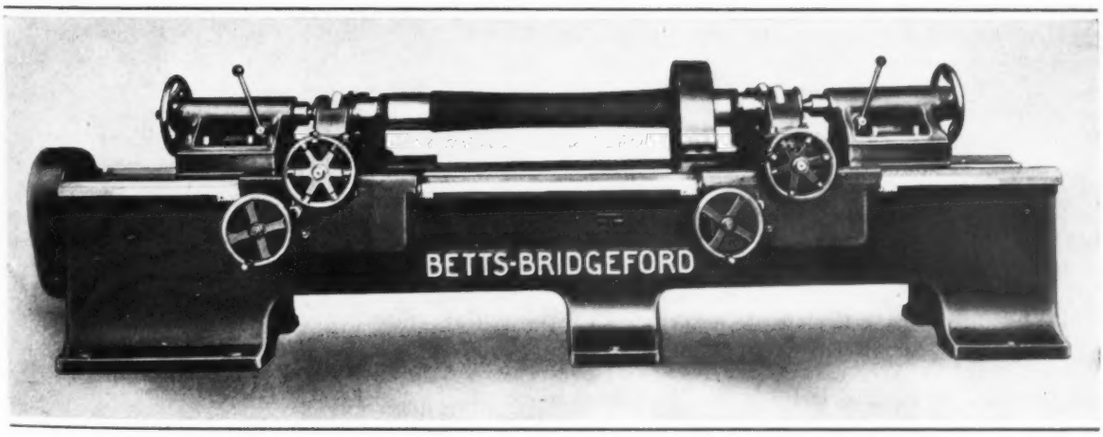


Fig. 3. Lathe for Burnishing the Journals of All Sizes of Car-wheel Axles

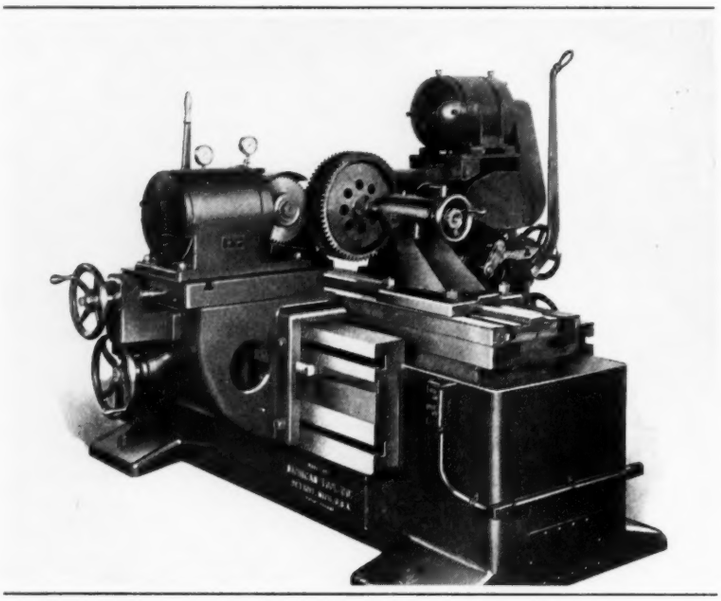


Fig. 1. Michigan Universal Lapping Machine Set up for Lapping Both Sides of a Herringbone Gear

Fig. 2. Front and Back of Gear Teeth Lapped without Reversing

In operation, the light and easily handled chuck is slipped over the end of the axle to the finished surface of the right-hand wheel seat. The axle is then placed between the centers of the machine and the chuck is tightened on the wheel seat in mesh with the driving gear in the bed. The burnishing rollers are mounted on Timken bearings and float as a unit to relieve the centers, carriages, and bed from side pressure.

At the beginning of an operation, the fillet on the collar end of one journal is burnished by applying pressure on the cross-feed and longitudinal-feed hand-wheels. Then the rolls feed across the journal until they reach the inside fillet, where they stop and remain stationary until the operator burnishes this fillet by operating the hand-wheels. After one set of rollers has been started in operation, the other set is started on the opposite journal.

Allowing for two passes of the burnishing rollers, the production of this machine on an average-sized axle is sufficient to keep two or three axle lathes busy rough- and finish-turning the wheel seats, journals, fillets, dust guards, and collars.

Michigan Crossed-Axes Gear-Lapping Machine

Flexibility of application is a feature of a universal crossed-axes gear-lapping machine being placed on the market by the Michigan Tool Co., Detroit, Mich., the machine being suitable for lapping gears ranging from 1 1/2 to 20 inches in diameter, and accommodating clusters up to 30 inches in length. The change-over time for gears of the same pitch and helix angle is about five minutes, while twenty minutes is ample for making the changes necessary to suit gears of entirely different characteristics, although a change of the laps is involved.

The machine is of duplex type, having two laps that can be used either for lapping the front and back sides of gear teeth at the same time with the machine running in one direction only, or for lapping two separate gears (as on a cluster) simultaneously. This construction reduces the handling time 50 per cent and increases the production rate proportionally.

The automatic cycle of the machine can be adjusted to make the lapping period anything from five seconds to twenty minutes in both directions, the machine running first in one direction, reversing, running the same length of time in the other direction, and then stopping.

The lap at the back of the machine is the driving member, and is driven, in turn, by a three-horsepower motor. The work is mounted either between centers or on an arbor. The centers are attached to a reciprocating table, the stroke of which can be adjusted up to 5 inches. This table is driven through a second motor of three horsepower capacity.

The work itself drives the second lap at the front of the machine. This lap is equipped with an adjustable hydraulic brake that provides a means of obtaining the desired lapping pressure between the laps and the gear teeth. Both lapping heads are mounted on slides, so that they can be moved into any desired position, which construction permits of lapping two gears of different diameters at the same time. Reloading is facilitated by operating a hand-lever which disengages the front lap. In returning the lap after loading, its head is accurately located against stops. The driving lap is always left in the operating position.

Norton Cylindrical Grinding Machine with Automatic Loading Mechanism

A completely automatic 10-inch Type C cylindrical grinding machine designed for plunge-cut operations has recently been developed by the Norton Co., Worcester, Mass. This machine is arranged for the high production of cylindrical parts concentric with their axes, with a minimum amount of attention on the part of the operator. The manual work consists simply of keeping a feed chute supplied with work, compensating for wheel wear by means of a standard mechanism that is adjustable to 0.0001 inch, and truing the grinding wheel when necessary to maintain the desired finish. The wheel-truing mechanism is hydraulically operated and is built into the wheel guard.

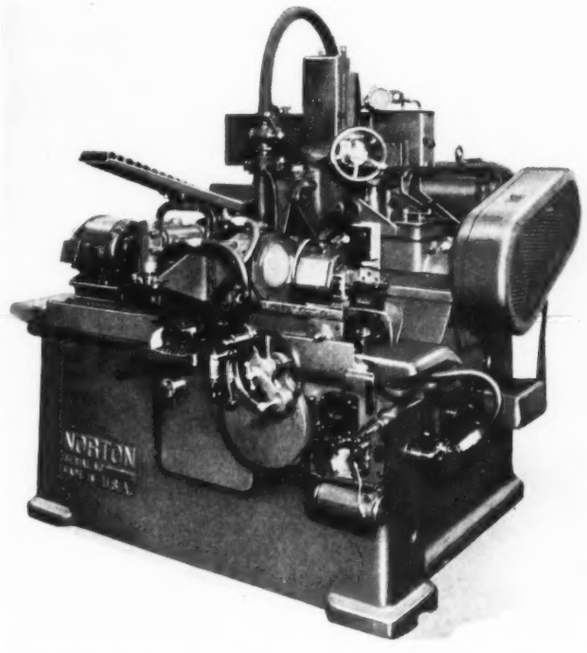
The automatic grinding cycle includes placing the work in the holding and driving position, grinding accurately to the desired size, releasing the finished piece, and dropping it into a chute that leads to a receptacle. The time required for the automatic cycle is regulated by means of a hydraulic valve which can be adjusted during the operation. An important feature of this machine is that if any mechanism fails to perform its functions, all other mechanisms stop automatically.

The design of the headstock, footstock, and work-holding fixtures can be varied to suit the work and the grinding requirements. The chute type loading fixture illustrated is arranged for handling steel bushings that are splined internally. Hydraulically actuated fingers at the bottom of the chute pick off a bushing and advance it between the centers of two live-spindle synchronized work-heads. At the same time, the previously ground bushing is removed and dropped into the finished-work chute. A grinding wheel 24 inches in diameter and up to 5 inches in width or 20 inches in diameter and up to 7 inches in width can be employed.

Cincinnati Wet Abrasive Cut-Off Machine

The Cincinnati Electrical Tool Co., Cincinnati, Ohio, has just brought out the wet abrasive cut-off machine here shown, which is suitable for straight or angular cutting of practically any material used in general manufacture, including steel alloys, non-ferrous metals, and fibrous and plastic materials. The machine can be used for solid stock up to 2 1/4 inches in diameter or tubing up to 3 1/2 inches in diameter; but in cutting to angles up to 45 degrees, the maximum capacity is 2 1/4 inches. Graduations on the table facilitate angular cutting.

The material to be cut is held in the vise by spring tension applied on the jaws, and is released after the cut is completed by the operation of a foot-lever. This leaves the operator's hands free at all times. The work is gripped on both sides of the cut, so as to



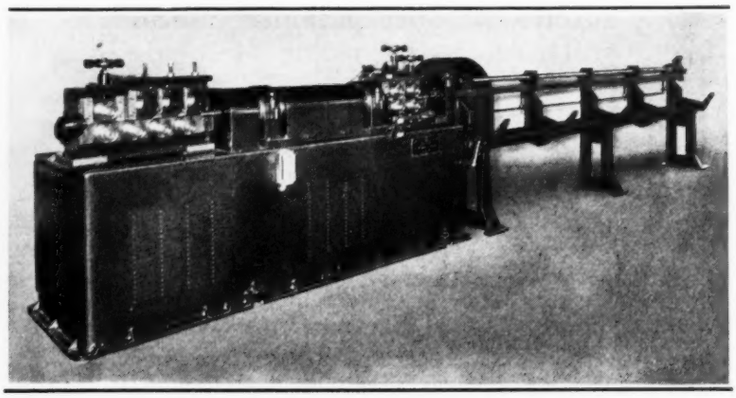
Norton Cylindrical Grinding Machine Arranged for Completely Automatic Operation

Wet Abrasive Cut-off Machine Built by the Cincinnati Electrical Tool Co.

eliminate possible cramping and wheel breakage.

The abrasive wheel is fed into the work by means of a hand-lever. The arm that carries the abrasive wheel is pivoted on the pedestal and counterbalanced for easy operation. Stops can be set to regulate the depth of cut and the length of pieces cut off.

Two sets of wheel flanges are furnished to enable maximum use of the abrasive wheels. A shaft-locking device facilitates the making of wheel changes. The wheel-spindle is mounted in deep-groove ball bearings, and is regularly driven through multiple V-belts by a 7 1/2-horsepower ball-bearing drip-proof motor, although motors of 10- and 15-horsepower capacity can be supplied. The coolant system includes a 1/4-horsepower direct motor-driven centrifugal pump and a 10-gallon tank.



Shuster Automatic Wire Straightening and Cutting Machine of Recent Design

Shuster Dual-Control Wire Straightening and Cutting Machine

Two ball-bearing fully enclosed variable-speed units, a high-speed cut-off cam, and a quick-acting clutch are features of an automatic wire straightening and cutting machine recently developed by the F. B. Shuster Co., New Haven, Conn., which eliminate the possibility of marking or swelling wire. The machine automatically feeds wire from a coil, straightens it, and cuts it accurately to length.

Infinite speed changes are obtainable for the feed and cut-off through the variable-speed units, and they can be made without stopping the machine. One handle at the front of the machine operates the feed and the rough roll-straightening units, while another handle operates the cut-off. The preliminary roll straightener removes the bow existing as the wire is drawn from the coils and rough-straightens the wire before it enters the rotary flier. The latter is of a standard five-die design and is used for finish-straightening. Square dies with guides between are used.

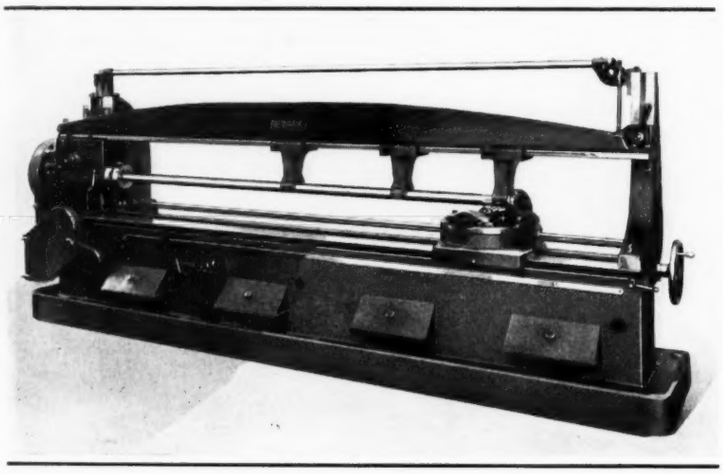
The various units of the machine are mounted on a welded steel base. Straightening and feed shafts are mounted in Timken roller bearings, and driveshafts in Norma-Hoffmann ball bearings. The variable-speed units can be omitted when a constant-speed machine is desired.

Newark Hobbing Machine for Long Spiral Gears and Spline Shafts

A special No. 3 hobbing machine with a face capacity of 108 inches has recently been built by the Newark Gear Cutting Machine Co., Inc., 69 Prospect St., Newark, N. J. This machine is fully universal, providing for the hobbing of spline shafts and long spiral gears. The face capacity of the standard No. 3 machine is 14 inches.

On the special machine, there are eight heads for supporting the work, and the work-spindle has a 3 1/2-inch hole. The base is equipped with ten adjusting screws, so as to facilitate leveling. There is also a screw on the outer end of the overhanging arm which provides an adjustment to insure that the work is always parallel with the machine base.

Except for the increased capacity, this special machine is of the same design as the standard model, which has previously been described in MACHINERY.



Newark Gear-hobbing Machine with a Face Capacity of 108 Inches

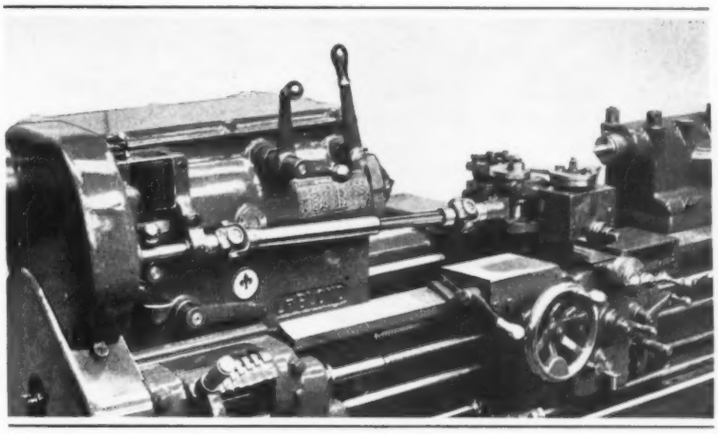
Universal Relieving Attachment for LeBlond Tool-Room Lathes

An improved fully universal relieving attachment that provides any amount of relief from 0 to 1/4 inch by the use of only two cams has been brought out by the R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, for application to the tool-room lathes of its manufacture. The majority of work within the range of the attachment can be handled without angularity of the knuckle joints, and under the most extreme conditions, the knuckles assume only a slight angle. External, cylindrical, internal, end, side, angular, and spiral relief are obtainable with this attachment.

The driving mechanism is attached to the headstock in such a way that it does not interfere with the ordinary use of the lathe. Power is transmitted through a telescopic shaft to the actuating mechanism on the tool-slide which replaces the regular compound rest. The tool-slide can be swiveled to the desired angle for angular, side, or end relief. Graduations facilitate the making of accurate settings. Only a few minutes are required to replace the regular compound rest with the relieving attachment slide.

The drive to the actuating mechanism is transmitted through a pair of miter gears, the driving gear of which can be swiveled around the center of the driven gear. This construction permits the driving shaft to remain straight, regardless of the angular setting of the tool-slide.

The driving cam revolves constantly and imparts an oscillating motion to a follower cam, mounted on a vertical eccentric shaft. This shaft can be adjusted in relation to the follower cam. It is oscillated by the master cam, while the follower cam imparts the reciprocating motion to the tool-slide by means of an eccentric and a connecting-rod. The motion imparted to the eccentric shaft being constant, variation of the tool stroke is accomplished by adjusting the eccentricity of the vertical shaft.



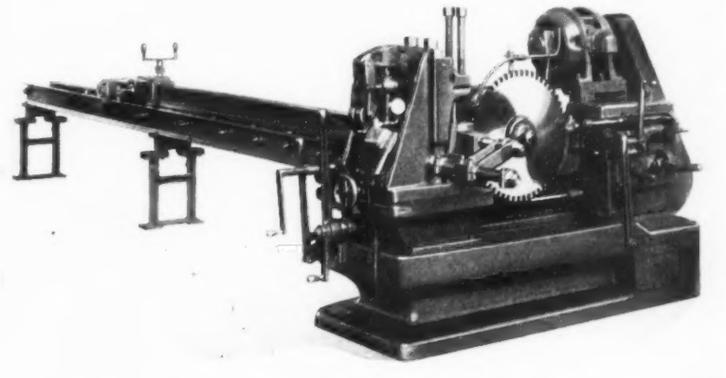
LeBlond Tool-room Lathe Equipped with Universal Relieving Attachment of Improved Design

Cochrane-Bly Sawing Machine Arranged for Square and Rectangular Bars

The Cochrane-Bly Co., Rochester, N. Y., has developed special apparatus for handling square and rectangular bars on the metal-sawing machines built by the concern. This equipment will grip a bundle of bars at one end and feed them all the way to the saw blade. The apparatus applied to the No. 55 sawing machine here illustrated will hold forty bars 1/4 inch thick by 2 inches wide or twenty bars 1/2 inch thick by 2 inches wide.

The bars are supported on rolls and are held in a carriage that extends from the machine bed to the saw blade. The stock carriage is fed forward through a chain and sprockets operated by means of a crank handle.

The vise is air-operated through a compound toggle link, and is practically instantaneous in its movement, as it requires less than five seconds for unclamping, feeding the stock to the gage, reclamping, and starting the saw feed. A lateral clamp keeps the bars aligned.



Cochrane-Bly Metal-sawing Machine with Special Equipment for Handling Square and Rectangular Bars

Gallmeyer & Livingston Hydraulic Surface Grinder with Cross-Traveling Head

A high-speed cross-traveling wheel-head is one of the features of a hydraulic-feed surface grinder being placed on the market by the Gallmeyer & Livingston Co., 305 Straight Ave., S.W., Grand Rapids, Mich. The machine illustrated has a table working surface of 16 by 48 inches, but machines with tables of other widths and lengths are available.

The cross-traveling spindle slide has a total movement that enables the standard 4-inch wide wheel to over-run the table working surface a distance of 2 inches, both at the front and back. The cross-travel normally operates upon each reversal of the table in increments of from less than 1/32 inch up to 2 inches. The total cross-travel can be governed by adjustable dogs. When the complete cross-feed has taken place in one direction, the feed is automatically reversed.

A lever provides for reversing the cross-travel by hand if reversal is necessary before the dogs have been reached. The amount of feed that occurs with each reciprocation of the table is adjusted by the small handwheel on the valve plate mounted on the front of the machine bed. This cross-feeding mechanism can be disconnected by operating a small lever on the right-hand side of the main head housing, which enables the head to be cross-traversed by hand through the handwheel located above the grinding wheel. In truing the grinding wheel, the lever in the center of the valve plate, which normally controls the table movement and its speed, is thrown to the left of center, so that the cross-movement occurs continuously.

The standard spindle construction includes a ball bearing of flange type with an adjustable amount of "preloading." The standard spindle drive is by means of a 25-horsepower motor running at 1150 revolutions per minute, which drives the spindle direct through its splined end. The motor is mounted on the vertical traveling head member, and thus the cross-traveling mechanism is relieved of the motor weight.

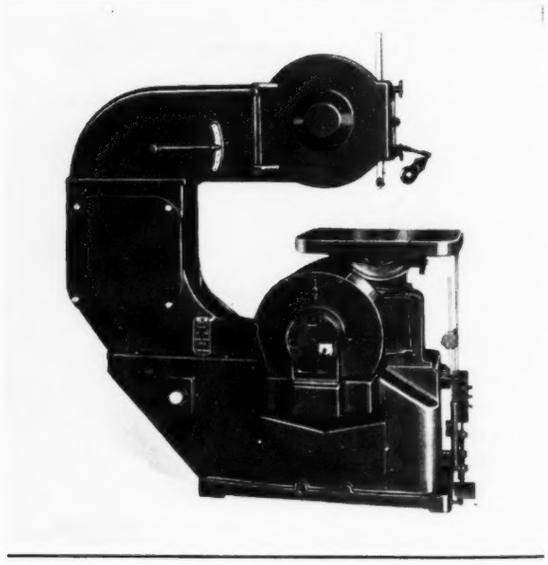
Power elevation of the vertically moving head slide is obtained through a 1/2-horsepower motor, controlled by the double-throw switch at the right-hand end of the valve plate. Movement occurs only as long as pressure is applied to this handle, the switch automatically returning to the neutral position when pressure is released. The table speed is infinitely variable from practically nothing up to a maximum of 150 feet a minute, when the machine is driven by a 60-cycle motor.

Grob Large-Throat Open-End Band Saw

An open-end band saw with a 36-inch throat, which will saw work up to 8 1/4 inches in height, has been placed on the market by Grob Bros., Grafton, Wis. One of the advantages claimed for this Type OS-36 machine is that it can be set up for internal sawing in twenty seconds, since no brazing or welding of the saw band is required. The machine is adapted for use on very small die work, as well as large work. The face of the saw band can be used as a file for finishing within 0.002 inch.

The large throat is obtained by means of a third 20-inch pul-

Gallmeyer & Livingston Hydraulic-feed Surface Grinder with Cross-traveling Wheel-head



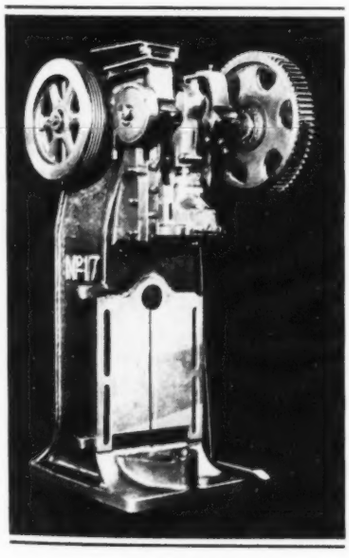
Grob Open-end Band Saw with 36-inch Throat which will Take Work 8 1/4 Inches High

ley on a swivel block in the upright column of the frame. The upper guide pulley is raised and lowered by means of a hand-lever at the left of the machine to provide proper tension on the saw band. If a foot-lever control is desired, a floor type switch can be placed wherever convenient.

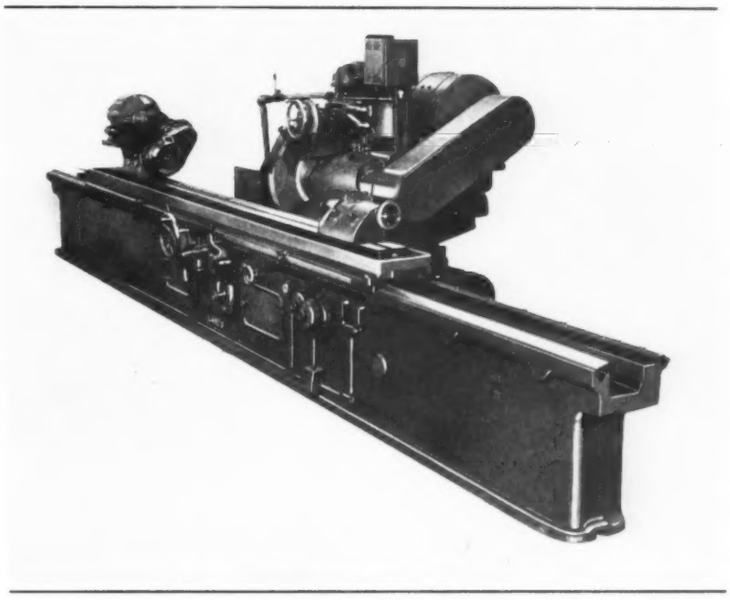
Niagara Horn Press

With the addition of a horn press having a shaft diameter of 4 inches to the line of machines built by the Niagara Machine & Tool Works, Buffalo, N. Y., this company now builds horn presses with shafts ranging from 2 1/4 to 4 inches. The design of the new machine includes a fourteen-point engagement sleeve clutch with built-in single-stroke mechanism, double V-gibs, a rigid slide with breech-block die clamp, and a self-contained back-gear assembly with anti-friction bearings. This assembly is mounted as a unit within the frame for accurate alignment.

The frame of the press is a steel casting. The shaft is mounted in bearings that are split at an angle of 45 degrees, so that thrust is transmitted directly to the frame rather than partly to bolted caps.



Horn Press with 4-inch Shaft, Recently Added to Niagara Line



Landis Hydraulic Grinding Machine for Long Work of Relatively Small Diameter

Landis 10- and 14-Inch Plain Hydraulic Grinding Machines

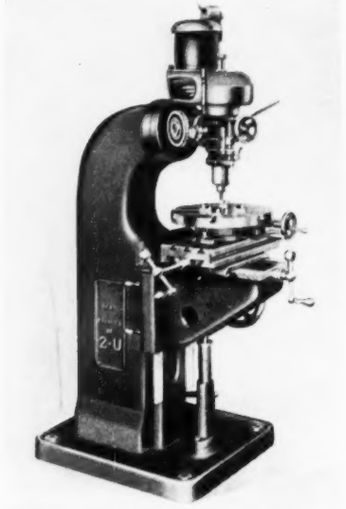
Plain hydraulic machines of 10- and 14-inch diameter capacities have been brought out by the Landis Tool Co., Waynesboro, Pa., for grinding relatively long work of small diameter, such as tinning rolls, steckel mill rolls, shafts, and spindles. When necessary, the table of these machines can be built with a gap, so as to accommodate work having projections. These Type BD plain hydraulic machines supersede the 10- and 14-inch Type B plain machines.

The dynamically balanced wheel-drive motor is mounted on the rear of the wheel-base and is connected to the wheel-spindle through multiple V-belts. This arrangement insures smooth delivery of power at all times and facilitates belt changes. The babbitt-lined steel wheel-spindle bearings are flood-lubricated with filtered oil. The oil-pump is driven by a gear on the spindle, thus insuring lubrication from the moment that the wheel starts to rotate. Sight-feed valves enable the operator to check and regulate the flow of oil.

An important feature of the headstock is that multiple V-belts transmit power both from the motor to the jack-shaft and from the jack-shaft to the face-plate. One simple adjustment maintains the proper tension on the belts of both drives.

The hydraulic system consists of a low-pressure variable-flow pump and a motor. Both are of simple design, all parts run in oil and anti-friction bearings are used. The hydraulic system provides table speeds ranging from 12 to 240 inches a minute.

A motor mounted at the rear of the bed drives the oil-pump located within the bed through multiple V-belts. The water-pump shaft extends through the bed from the other side and is coupled to the end of the oil-pump shaft. The water pump is of the centrifugal self-priming type. Its bearings are fully protected from water, and the suction line is cast integral with the body, so as to eliminate air leaks. When a direct-current generator is required for the headstock motor, it is mounted on the bed in such a position that it can be driven from the water-pump shaft through multiple V-belts.



Universal Milling Machine for General Tool and Die Work

Reed-Prentice Universal Milling Machine

A No. 2U universal milling machine especially adapted for general tool and die work is being introduced on the market by the Reed-Prentice Corporation, Worcester, Mass. The self-contained motor-driven head of this machine is capable of milling, drilling and boring at all angles. It can be swiveled to any angle relative to the longitudinal feed, to any angle up to 60 degrees relative to the cross-feed from the center of the machine toward the column, and to any angle up to 30 degrees from the center toward the front of the machine.

The longitudinal feed of this machine is 16 inches; the cross-feed, 11 inches; the vertical feed of the knee, 15 inches; the working surface of the rectangular table, 20 1/4 by 8 7/8 inches; and the diameter of the working surface on the rotary table, 15 inches.

The spindle is machined to either a No. 2 Morse taper or a No. 7 Brown & Sharpe taper. The spindle quill is treated with a chromium process which gives it an unusual surface hardness. The quill is fitted with a graduated depth stop and a positive lock. A blower can be furnished for clearing the work of chips.

Machine for Honing Bores as Small as 1/4 Inch in Diameter

"Microhoner" for Honing Small Bores

The Micromatic Hone Corporation, Dubois St. at Horton Ave., Detroit, Mich., has developed the honing machine here illustrated for the accurate finishing of bores ranging from 1/4 to 7/8 inch in diameter. The maximum length for pieces of the smallest diameter is 2 3/4 inches, and for those of the largest diameter 7 1/2 inches. Bores as small as 1/4 inch in diameter, it is stated, are being honed in production on this machine within a roundness and straightness tolerance of only 0.000025 inch by a manufacturer of Diesel fuel injectors.

The "Microhoner," as this machine is called, is provided with a wobble plate which produces a high-speed reciprocating motion. This, in combination with rapid rotation, results in a spiral or helical travel of the abrasive which produces a cross-hatch honed finish. Any desired variation of the cross-hatch or of the relative speeds of operation can be obtained by interchanging pulleys.

Starting and stopping of the machine are controlled through the foot-pedal. A single foot movement engages the clutch and expands the hone. Also, one foot movement stops the reciprocation and rotation, the clutch being released and the brake applied simultaneously with the collapse of the hone.

Production ranges up to 200 pieces an hour. A mirror-like finish is produced in one operation on hardened parts having a ground surface or on soft steel, cast iron, and some non-ferrous metals having a precision-bored, reamed, or broached surface.

Strand Tool- and Die-Makers' Flexible Shaft Machine

A flexible shaft machine designed specifically for the use of toolmakers and diemakers has been added to the line of N. A. Strand & Co., 5001 N. Wolcott Ave., Chicago, Ill. This Type MY-4 machine is driven by a 1/4-horsepower motor. Two combinations of speeds are available through the three-speed ball-bearing countershaft as follows: 1700, 3000, and 5200 revolutions per minute, and 3400, 6000, and 10,400 revolutions per minute.

The motor is mounted in a swiveling yoke which permits the machine to be swung into any required position. A four-foot flexible shaft furnished with a ball-bearing hand-piece having a split collet is supplied as standard equipment. The stand is

Flexible Shaft Machine for Toolmakers and Diemakers

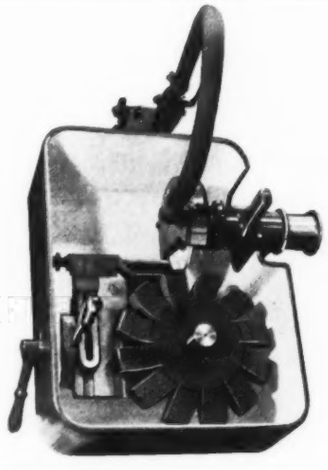
provided with an adjustment for raising or lowering the machine to convenient heights.

The same concern has also brought out a small ball-bearing right-angle attachment which is interchangeable with this new flexible shaft machine. The attachment is furnished with a split collet for holding tools having round shanks.

Newark Larger-Size Gear-Cutter Sharpening Machine

Formed cutters up to 15 inches in diameter can be accommodated by a No. 1 gear-cutter sharpening machine recently developed by the Newark Gear Cutting Machine Co., Inc., 69 Prospect St., Newark, N. J. This machine has all the principal features of the No. 0 gear-cutter sharpening machine built by the company, which was described in June, 1929, MACHINERY, page 793. The feed is so arranged that the cutter is always ground radially, or with each tooth having the same amount of hook.

The grinding-wheel spindle is mounted in Timken roller bearings, and the wheel is 8 inches in diameter. The work-table is pivoted, so that a cutter can be swiveled up and down in grinding the gashes.



Machine for Sharpening Gear-cutters up to 15 Inches in Diameter

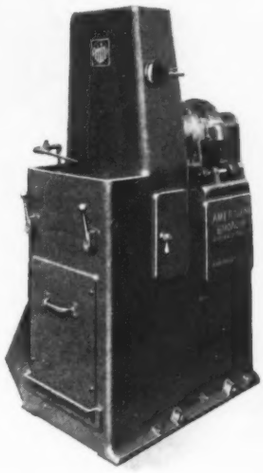


Fig. 1. American Pull-down Hydraulic Broaching Machine

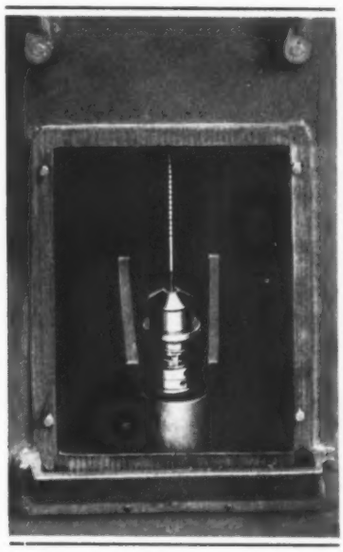


Fig. 2. The Automatic Broach Puller in its Lowest Position

American Hydraulic Broaching Machine of Pull-Down Design

A pull-down type of hydraulically actuated broaching machine designed specifically for fast internal broaching is the latest development of the American Broach & Machine Co., Ann Arbor, Mich. One of the features of this machine is that the ram, the hydraulic cylinder, and the accurately machined slide-ways together comprise a single casting. This construction permits a long stroke with a relatively low column height and brings the work-support into a convenient loading position. Another advantage claimed for this construction is that the mass of the moving ram and cylinder promotes smooth cutting. The broach-puller automatically releases the broach to permit easy removal of the work when the ram reaches its topmost position, and automatically grips the broach when the ram starts on its next downward cutting stroke.

The scraped slide-ways of the ram-cylinder casting bear upon bars of hardened and ground steel which are secured to the frame at the front and on both sides. Similar bars form caps at the rear of the bearing, so that the slide-ways are surrounded by hardened and ground steel bars throughout the entire length of their travel. It is claimed that with this construction and a bearing of large area, the original accuracy of the machine is retained through years of heavy-duty service. Automatic lubrication is provided for the slide-ways.

A Sundstrand hydraulic unit, completely submerged in oil, actuates this machine. It is driven by a five-horsepower motor through multiple V-belts. The hydraulic circuit includes an adjustable safety valve, and is controlled by a four-way valve. A fan type gage, protected by a shut-off cock, shows the pressure of the hydraulic circuit.

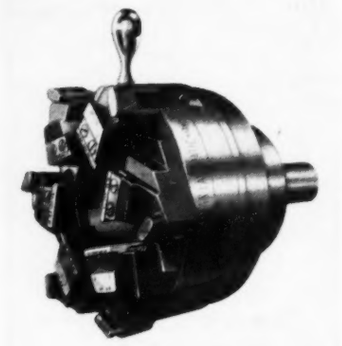
After the operator places a work-piece on the pressure plate and passes the broach through the work into the pulling head, he places his right hand on the operating lever and his left hand on a safety lever. Both levers must be moved at the same time to start an operation. At the end of an operation, the work-piece is first removed, then the ram is returned to its starting position, and, after the broach has been lifted out, the machine is ready for the next cycle.

Changes from one type of job to another are readily made by simply substituting a suitable broach guide and broach. The important specifications of this machine are as follows: Capacity, 4 tons; maximum stroke, 22 inches; cutting speed, 30 feet per minute; and return speed, 40 feet per minute.

Wilson Transformer Type Arc Welder

A transformer type of alternating-current arc welder with a rating of 150 amperes has been added to the line manufactured by the Wilson Welder & Metals Co., Inc., 60 E. 42nd St., New York City. With the addition of the new model, the company now manufactures alternating-current arc welders in capacities of 150, 300, 500, 750, and 1000 amperes.

Each welder is provided with three controls or adjustments of the welding current. Through the medium of the first two controls, twenty-five coarse adjustments can be obtained. The third control offers a fine adjustment of current values within any one of the twenty-five coarse adjustments. Hence, the three controls provide an infinite number of settings.



Die-head for Threads up to 5 1/8 Inches Diameter and 7 Inches Long

Landis Die-Head for Large-Diameter Threads

Threads from 4 to 5 1/8 inches in diameter with from 7 to 20 threads per inch can be cut by a new die-head recently added to the Landmatic Series of the Landis Machine Co., Inc., Waynesboro, Pa. While not unlimited, the length to which threads can be cut with this die-head is unusual. For example, the particular head illustrated has a capacity for cutting threads up to 7 inches long on 5 1/8-inch diameter work.

This new die-head is of the self-opening pull-off type and is applicable to turret lathes and hand screw machines. Six chasers are mounted on the face of the head in a similar manner to the mounting of four-chaser die-heads. Six chasers are provided so as to distribute the cutting load more widely. It is claimed that this construction results in an increase in tool life, because more threads are obtained per grind of the chasers. Improved quality of the threads is another advantage.

Diametral graduations on the die-head and micrometer graduations on the adjusting screw enable rapid changes in threading size.

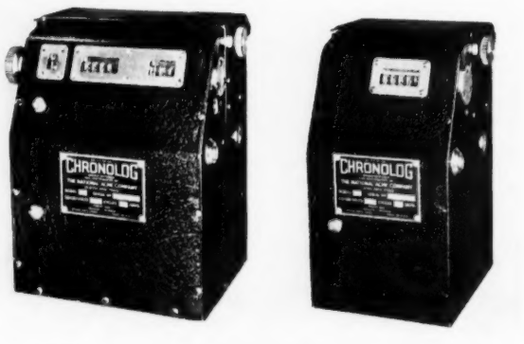
"Chronologs" for Making Records of Machine Operation

Two improved "Chronologs" for use in measuring and controlling idle machine or man time have been brought out by the National Acme Co., 123 E. 131st St., Cleveland, Ohio. The Model M instrument, shown at the left in the illustration, can be applied to any machine or operation. In starting work, the operator turns on the Chronolog, which prints the exact time on a 4 1/2-inch tape. The window at the upper right hand side of the instrument shows the clock time, and the larger window to the left registers the number of units produced.

If the work is interrupted, the operator turns the knob at the left to a symbol indicating the reason for the interruption. This is then registered on the Chronolog tape. When production is resumed, the operator pushes a button on the front of the Chronolog, causing the time at which production was resumed to be recorded on the tape.

Every ten minutes, the Chronolog prints the count of units produced and the time. Visits of the foreman, inspector, stockkeeper, or others to a machine can be recorded on the Chronolog tape. Thus, at the end of the day, the printed record shows how many minutes the machine was in operation, the number and extent of all interruptions, the reason for these interruptions, and the production of the machine.

The Model O Chronolog, shown at the right, contains only one set of digit wheels, which can be arranged to count idle time or units produced. It carries a tape roll which automatically prints every ten minutes or a printing can be obtained at any time by inserting a card and pushing a button on the front of the instrument.



Two New "Chronologs" Brought out to Record Machine Performance

Fig. 1. Push-button Station with Mushroom Head on Stop-button

Fig. 2. Treadle-operated Water-tight Push-button Station

Recent Products of the General Electric Co.

A slap of the open hand on the "mushroom" head of the push-button station shown in Fig. 1 suffices to stop a machine that is controlled by the device. This switch, which was recently placed on the market by the General Electric Co., Schenectady, N. Y., is particularly suitable for use on machines where the operator is required to wear heavy gloves or asbestos mittens. It was developed primarily, however, for use in bakeries, where it is important that dough from the operator's hands does not work into the switching device.

This push-button station is of the same general construction as the standard GE heavy-duty push-button station, except that the molded stop-button to which the mushroom head is fitted is approximately 1/2 inch longer. The mushroom head is screwed to a metal insert in the end of this button. The new push-button station is also available without the mushroom head and with the insert undrilled.

For installations in which the operator must have both hands free while starting or stopping a machine, the company has developed the treadle-operated water-tight push-button station illustrated in Fig. 2. This device is available with either a single- or a double-action treadle. The treadle operates a standard heavy-duty push-button unit within the case. Stops limit the travel of the treadle in either direction, so that the operator can depress it firmly without endangering the electrical parts of the device. A spring automatically returns it to the neutral position when pressure is released.

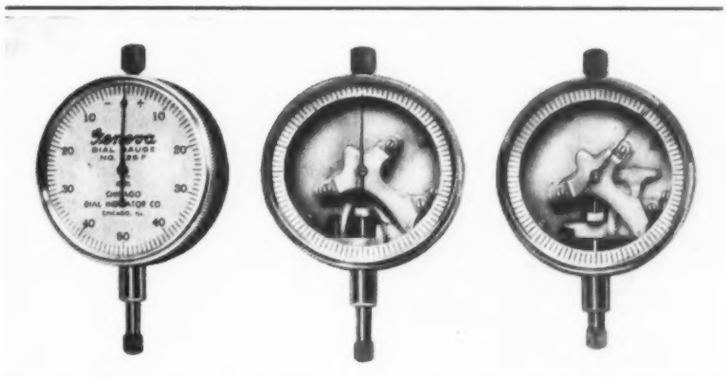
Quick production of workable glue and careful regulation of glue temperature are advantages claimed for an automatic glue pot also brought out by the same concern. This pot is designed to heat rapidly until a temperature of from 140 to 150 degrees F. is reached, after which this temperature is automatically maintained. The pot has a capacity of two quarts, and is available for use on 115- or 230-volt alternating or direct current.

Another new product of the company is a cartridge type heating unit intended to provide a "spot" of heat in a limited space. This unit is only 3/8 inch in diameter, and is designed for a maximum operating temperature of 750 degrees F. It is adapted for built-in applications, and is available in ratings of 30, 75, and 90 watts at 115 or 230 volts, alternating or direct current.

Geneva Precision Dial Indicator

A lever arm instead of the usual multiplicity of gears is a feature of the Geneva dial indicator now being placed on the market by the Chicago Dial Indicator Co., 180 N. Wacker Drive, Chicago, Ill. This construction feature is said to reduce friction and the chance of error. In the middle view of the illustration, the lever arm is seen at the start of its travel, and in the right-hand view at the end of its movement, in taking a typical reading. The indicator reads to 0.001 inch.

The movement is mounted between separate top and bottom plates. The case and plunger housing are machined from a one-piece nickel-silver casting. Removal of the back does not expose the working parts to dust or dirt. The instrument is 2 inches in diameter by 7/16 inch thick, not including the curva-



Geneva Dial Indicator that Gives Readings through the Action of a Lever Arm

ture of the crystal. The plunger is 5/32 inch in diameter and has a travel of 3/16 inch.

A plain back or conventional holder can be supplied to fit existing fixtures, and there is also an attachment available for use in testing internal and other surfaces that cannot be reached with the regular plunger. This attachment fits the stem of the indicator and is held by a knurled clamp screw. Three different styles of contact points are regularly available, and special points can be supplied.

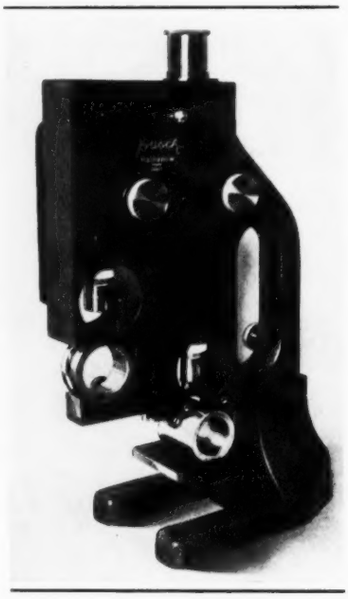
Microscope for Comparing Surface Finishes

Metal surfaces can be closely examined for quality of finish after turning, grinding, lapping, hardening, and other operations by means of the Busch comparison microscope here illustrated, which is being introduced on the American market by the George Scherr Co., 124 Lafayette St., New York City. This instrument provides a convenient means of observing machining marks, fractures, hardening cracks, and other flaws.

In using the instrument as a comparator, the master is placed in the V-block at the front and the work is positioned on the adjustable flat stage. Images of both parts highly magnified can then be observed in the common eye-piece directly beside each other without any separating line. This permits an easy and positive comparison.

The instrument can also be used for observing the surface of only one part in the full field of view which the eye-piece affords. In this way, it provides a shop or laboratory microscope with a built-in illuminating arrangement.

Illumination is obtained with two frosted bulbs in such a way that cylindrical or curved surfaces appear as a flat field in the eye-piece. The microscope is mounted on a cast-iron stand, from which it is conveniently removable so that it can be applied directly on work mounted in a machine. This permits observation of surfaces during finishing operations.

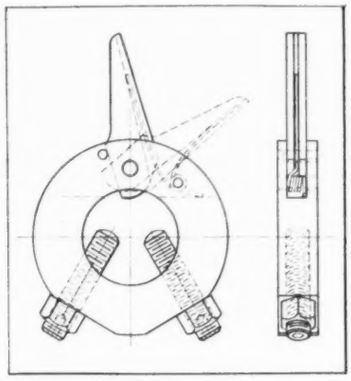


Microscope Adapted for Comparing the Surface Finish of Parts

Lincoln Electrode for Flat-Welding Deep-Groove Joints

An arc-welding electrode that has been developed especially for use in flat-welding deep-groove joints in mild steel is being introduced to the trade by the Lincoln Electric Co., Cleveland, Ohio. This "Fleetweld 9" electrode is especially suitable for use in the manufacture of tanks, pressure vessels, etc., which are of a heavy plate construction and are butt-welded. The use of this electrode is said to eliminate the tendency to form surface holes in the welded metal, and to insure uniform performance.

Weld metal from this electrode will have a tensile strength, as welded, of from 66,000 to 74,000 pounds per square inch, while weld metal stress-relieved at 1200 degrees F. will have a tensile strength of from 64,000 to 72,000 pounds per square inch. The electrode is made in sizes of 3/16, 1/4, and 5/16 inch.



Improved Cam Type Grinder Dog Made by the Ready Tool Co.

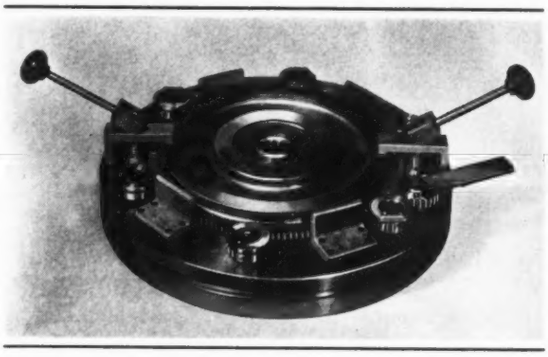
Quick-Acting Cam Type Grinder Dog

A number of improvements recently made in the design of the cam type of dog produced by the Ready Tool Co., 550 Iranistan Ave., Bridgeport, Conn., can be seen from the illustration. An important feature of this dog, which is intended primarily for grinding machine applications, is that the operator can handle it quickly with one hand. The dog is positive in its action, has a wide range of adjustment, and does not require the use of a wrench, except when changing to different sizes of work.

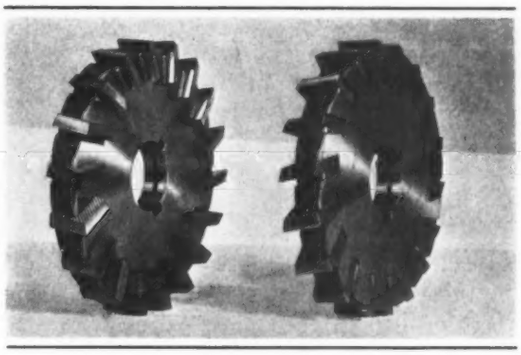
Safety set-screws are provided, and they are positioned at an angle of 60 degrees, so that three-point contact is always obtained, regardless of the work size. Four overlapping sizes of the dog take a range of work from 1/4 inch to 2 inches round.

Garrison Gear Chuck for Ring Gear Assemblies

A gear chuck designed for accurately chucking automobile-flywheel and similar assemblies embodying a ring gear has been developed by the Garrison Machine Works, Inc., 8 Norwood Ave., Dayton, Ohio. The gear is located in the chuck by gear segments, spaced at intervals around the body, as shown in the illustration. This method of locating the work for finishing the bore in the inserted member



Garrison Chuck Designed to Locate Ring Gears from Pitch Line



Adjusto-Lock Inserted-blade Milling Cutters

after it is assembled in the ring gear, instead of before the assembling operation, as was the former practice, has been developed to eliminate the difficulty previously experienced in maintaining concentricity of the bore with the pitch line of the gear.

The chuck is especially suited for use in plants manufacturing heavy machinery, automobiles, tractors, and other equipment in which hardened gears with pressed-in cast or soft inserts, flanges, etc., must have their bores or cylindrical surfaces machined concentric with the pitch line of the gear teeth.

Hydraulic Self-Stripping Punching Unit

The self-stripping hydraulic punching unit here illustrated has been developed by the Progressive Welder Co., 737 Piquette Ave., Detroit, Mich., for use in punching sheet-metal parts. This use of individual punching units is said to reduce the cost of dies. They can be positioned to suit curved or irregular-shaped parts. Each unit can punch one hole or a group of holes in a single movement through sheet steel up to No. 11 gage.

The hydraulic stripper positions the work against the die before punching and releases it after the operation. The stripper prevents distortion of the material and insures holes without burrs. The units are connected to a master control valve which starts the punching operation with a single movement. Clamping devices can be provided for holding the work in fixtures required for large irregular-shaped parts. The hydraulic pressure necessary for operating the units and clamping devices is supplied by means of electrically driven pumps.

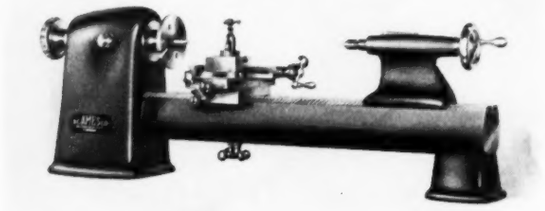
Machine Equipped with Two Hydraulically Actuated Punching Units

Adjusto-Lock Inserted-Blade Milling Cutters

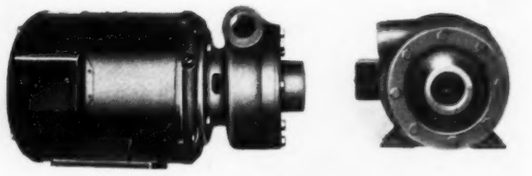
Positive locking of the blades in any position and universal adjustment are features of the Adjusto-Lock inserted-blade milling cutters being introduced on the market by the National Twist Drill & Tool Co., Detroit, Mich. The interlocking arrangement of the blade and body of these cutters is such that the two members must be moved apart before any lateral movement can take place. More than 300 anchoring points per square inch of blade surface are provided to prevent shifting of the cutters in operation.

It is possible to adjust the blades in any direction desired and to hold them securely in place. Adjustments are made by removing the wedges, shifting the blades to the right, left, or radially, as desired, and then resetting the wedges, after which the cutter is ready for sharpening and further service. The adjustment spacings are close together, so that there is a minimum amount of waste in adjusting and regrinding the blades.

The complete line includes side milling cutters with straight and staggered teeth, face milling cutters, half-side or straddle mills, and shell end-mills.



Ames Precision Bench Lathe with Detachable Head



Pioneer Pump Designed for Applications where a High Head is Essential

Ames Enclosed-Head Precision Bench Lathe

Increased power for heavier cuts and higher spindle speeds through a direct motor drive are advantages of the No. EH 3 precision bench lathe recently added to the line of machines made by the B. C. Ames Co., Waltham, Mass. The detachable headstock is an important feature of this lathe. It is driven by fully enclosed double V-belts and is equipped with preloaded precision ball bearings, a hardened and ground alloy-steel spindle, a conveniently located locking pin, and a ball thrust bearing for the draw-back spindle. The headstock bearing is hand-scraped to fit the bed. The entire headstock assembly can be taken apart and put together in a few minutes.

The lathe is driven by a New Departure variable-speed Transitorq driving unit which provides speed changes by means of a handwheel control. Spindle speeds from 200 to 2000 revolutions per minute are obtainable with a 1/2-horsepower alternating-current or direct-current motor. Other speeds can be obtained as determined by the diameters of the pulleys used.

The length of the lathe bed is 36 inches and the maximum center distance, 17 1/2 inches. The swing over the bed is 8 3/8 inches in diameter. The collet has a 1-inch capacity.

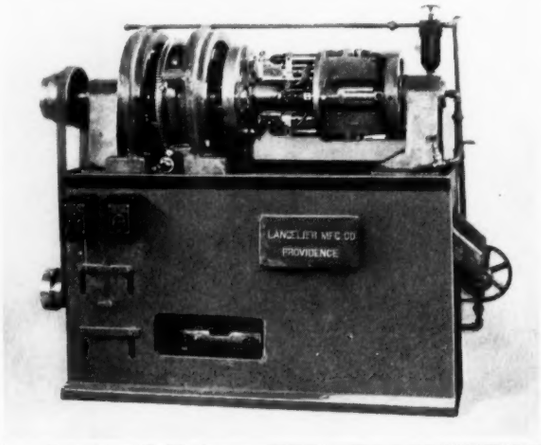
Pioneer Horizontal Coolant and Lubricant Pump

An open-impeller type pump of horizontal design, which is direct-connected to a ball-bearing moisture-proof motor, has been placed on the market by the Pioneer Engineering & Mfg. Co., 31 Melbourne Ave., Detroit, Mich., for pumping coolants and lubricants. This pump is particularly designed for installations requiring a high head, as, for instance, in multiple or deep-hole drilling, in pumping filtered coolants, and in connection with a central reservoir system that serves a battery of machines.

Although the pump is normally installed in a horizontal position, it can be mounted vertically if desired. A special mechanical seal used at the shaft opening makes the installation unusually compact and prevents shaft whip. This seal also eliminates shaft friction, and does not require repacking during the service life of the pump.

Langelier Continuous Cap-Screw Drilling Machine

A continuous type of machine designed for the drilling of cap-screws has recently been developed by the Langelier Mfg. Co., Providence, R. I. This machine is equipped with four horizontal drill spindles which are stationary, the work being rotated instead of the drills. The work-pieces are chucked in spring collets.

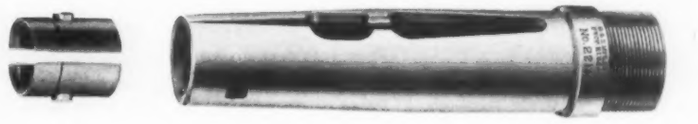


Langelier Cap-screw Drilling Machine, in which the Work Revolves and the Drills are Fed Horizontally

The work-carrier rotates about fixed cams which automatically open and close the chucks, eject the drilled cap-screws, and stop the rotation of the collets as they reach the loading position. The carrier is driven through worm-gearing and a three-step cone pulley which provides speeds of 6.6, 8, and 10 revolutions per minute. The collets can be run at speeds of 1400, 1800, and 2500 revolutions per minute.

The drills are fed by a fixed cam on the right-hand end of the machine. A section of this cam is interchangeable to provide drilling depths suitable for 1/4-, 5/16-, 3/8-, 7/16-, and 1/2-inch screws. Each drill spin-

dle is provided with a receding steadyrest which carries a guide bushing for accurately starting the drill into the work. The production of the machine ranges from 2400 quarter-inch screws per hour up to 1600 half-inch screws per hour.

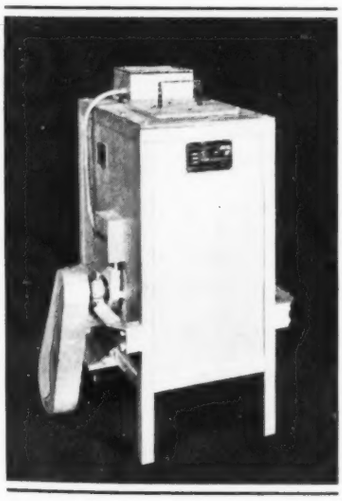


Brown & Sharpe Master Feeding Finger and Bushing for Automatic Screw Machines

Lindberg Laboratory Furnace

A small laboratory furnace for metallurgists has been brought out by the Lindberg Engineering Co., 224 Union Park Court, Chicago, Ill. This furnace is built on the same principle as the production type Cyclone furnace of this company's manufacture, and will serve as an accurate and inexpensive pilot furnace for checking up on production or for predetermining the response to specified heat-treatments, as well as for tempering small tools and individual steel parts. It has a work chamber 8 inches in diameter by 10 inches deep, and is provided with a plug type cover which is easily removed for inserting the load.

The electric heating elements are mounted in a separate chamber, thereby eliminating all direct radiation to the charge. A blower fan circulates the heated air through the work chamber. The temperature range is up to 1250 degrees F.



Lindberg Laboratory Furnace with Work Chamber 8 by 10 Inches

Brown & Sharpe Master Feeding Finger

Interchangeable round or hexagonal "pads" of hardened steel, bronze, or cast iron are features of a master feeding finger for automatic screw machines recently brought out by the Brown & Sharpe Mfg. Co., Providence, R. I. The hardened steel pads give maximum wear and are suited for most screw machine jobs, while the bronze pads are better adapted for feeding polished stock and have less tendency to mar or injure the surface finish. The cast-iron pads have a longer life than the bronze ones, and are suitable for feeding polished stock where requirements are not so severe as to require bronze pads. The entire finger is given a spring temper treatment which provides sufficient tension for holding the pads and stock. The two pads relieve the finger from wear and can be interchanged to meet different requirements as to material, size, or shape.

Feeding fingers and pads are regularly available for stock ranging from 1/8 to 7/8 inch in diameter, and special sizes or shapes can be made to order. A special wrench is furnished for opening or expanding the end of the feeding finger in order to insert the pads.

Bristol Portable Pyrometer

The millivoltmeter type of portable indicating pyrometer here illustrated has been brought out by the Bristol Co., Waterbury, Conn., for measuring temperatures up to 3000 degrees F., by using thermocouple and extension leads.

The use of a cobalt magnet provides increased sensitivity and a wide scale for unusually accurate readings. The high-resistance millivoltmeter movement is double-pivoted and completely shielded to prevent the effects of stray fields. The molded Bakelite case is moisture- and dust-proof and is of modern design. The instrument is available in single and double ranges.

Protector for Fractional-Horsepower Motors

A device for limiting the current supplied to fractional-horsepower motors is a recent product of the Micro Switch Corporation, 28 Exchange St., Freeport, Ill. This "Motor-Cop" protector permits a motor to operate under

Portable Pyrometer for Temperatures up to 3000 Degrees F.

Whitman & Barnes Reamer Made with Alternate Cutting Edges of Opposite-hand Spiral

overload until an unsafe temperature is reached.

In addition to the protection against excessive temperatures from overloads, there is a separate bimetal element which is actuated by current alone for opening the circuit promptly in case of a stalled rotor. This element functions in a different manner from the conventional design, in that it does not pull down the temperature at which the device functions on overload, and so does not over-protect at high loads. The device is small enough to mount inside the end bracket of standard motors from 1/8 to 1 horsepower.

Whitman & Barnes "Altercut" Reamers

Alternate right- and left-hand spiral cutting edges which give a double cutting action are the feature of a line of reamers known as the "Altercut," brought out by Whitman & Barnes, 2108 W. Fort St., Detroit, Mich. Each cutting edge of these reamers is both followed and preceded by an edge which cuts at a different angle to the axis of the hole, resulting in the production of very accurate holes having a fine finish. These reamers are made with straight and tapered shanks in sizes ranging from 1/4 inch to 1 1/2 inches.

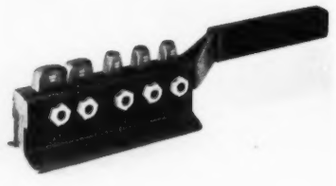


Fig. 1. Matthews Stamp-holder for Marking Pipe, Bars, and Tubes

Matthews Holders for Marking Stamps

Three different styles of holders for marking and numbering stamps have recently been added to the products of Jas. H. Matthews & Co., 3942 Forbes St., Pittsburgh, Pa. The holder shown in Fig. 1 is intended primarily for use in marking steel pipe, round bars, and cylindrical products. The design is such as to prevent off-angle blows that often make a stamp-holder fly from the hands of a workman, causing damage and injuries. This holder keeps the stamps in alignment and enables them to be placed firmly on the surface of the part to be marked, so that deep legible marks can be produced.

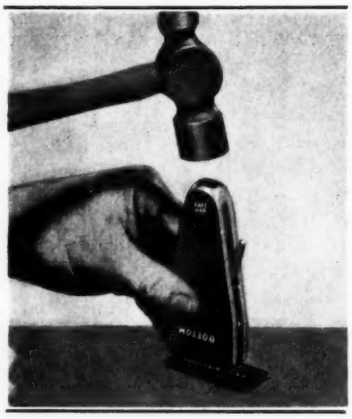


Fig. 2. Stamp-holder Designed for Marking Light Materials

The "Triumph" holder, shown in Fig. 2, was developed particularly for use in numbering, dating, and marking light products of metal, wood, fiber, and plastics. Up to eight stamps can be held, and all characters marked legibly and in alignment with one hammer blow. The holder has the "Safe Hed" which is obtained by a heat-treating and quenching process that is said to protect the head against chipping or mushrooming. The stamps are held in alignment by spring tension that acts on the side arm. When a slight pressure is applied on this arm, they are released for changing.

Fig. 3. Holder Designed for Quick Changing of Stamps

The "Quik-Change" holder, illustrated in Fig. 3, is especially designed, as its name implies, for quick changing of stamps. The stamps are released by merely applying a slight thumb pressure on a side button and then turning a pin. They are locked in place by turning the pin in the reverse direction. This holder was brought out primarily for severe steel mill use in marking billets, car wheels, forgings, and other products.

Electroloy Cold-Formed and Plated Electrodes

Spot-welding electrodes that are cold-formed from highly conductive alloys under a heavy pressure are a recent development of the Electroloy Co., Inc.,